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An Examination of Conditions in the Chicago Electronics Industry That Would Support the Use of Synthetic Validity

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AN EXAMINATION OF CONDITIONS IN THE CHICAGO ELECTRONICS INDUSTRY THAT WOULD SUPPORT THE USE OF SYNTHETIC VALIDITY

by

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VITA

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CHAPTER I

INTRODUCTION

Synthetic test validity, a process of test validation that uses as the test criterional measures the various levels at which workers perform within any of a number of common job factors, was introduced some fifteen years ago by Lawshe at Purdue. Since that time, although many have cited its value, little use has been made of the concept, and few have actually tested its worth in a research setting.

A discussion with a co-author of Lawshe, Dr. M. Steinberg of Belltone Electronics Company in Chicago, underscored the need to expand the concept of synthetic validity. The discussion also stressed the need to test the use of synthetic validity in an industrial setting, since previous studies had been limited in both scope and consequence. Previous studies proved merely that the concept works.

Before synthetic validity could be tested and used on a large scale, however, conditions had to exist that would favor its introduction. Could a test that was validated and used for one company be used for other similar companies as well? Would those same elements that facilitate the use of synthetic vali-

dation in test situations be found in more than one company? It was impossible to determine the answers to such questions at the time, because the personnel recruitment methods and procedures of most companies were not available for inspection and examination. For this reason, the first step in an investigation of conditions favoring the introduction of synthetic validity had to be a survey of the personnel needs and practices of a number of similar companies in metropolitan Chicago.

The Purpose

Primary Purpose. This study was undertaken basically to determine if synthetic test validity can be introduced into an industry of Chicago and if test selection instruments used by the industry can be validated on criteria that are established through job analysis and job evaluation, rather than on criteria based on the success factor. In other words, the primary purpose of the study was to examine the practicality of using synthetic validation as a means of improving the selection of applicants for jobs in the Chicago area through the use of screening tests that are validated on job factors or job elements. In addition, the study sought to determine if it is possible to develop a battery of common tests that could be used throughout an industry. Rather than having each company use and experiment with various measures of selection, this study proposed to develop a common test battery from the accumulated

research findings of many companies within the same industry. Such a method presupposed a degree of cooperation among companies as well as the fact of common selection problems.

Secondary Purposes. This study also explored the possibility of combining the job analysis and synthetic test validation processes. This combination should be possible because both synthetic validity and job analysis

1. Are both based on the assumption that the present employees are performing adequately
2. Are dependent on job factors
3. Require a stratified employee sample
4. Reject the success factor as a criterion

The study also attempted to assess the status of testing as it currently exists in a particular industry. Pilot studies indicated a reluctance of many companies to rely heavily on testing because of the stigma the Motorola case left on the personnel field (40). Other companies in the pilot survey felt that their small size made it difficult to utilize testing, because they were not able to validate the test instruments on adequate samples.

Description of the Problem

Synthetic test validity is a concept that apparently overcomes two very big problems of selection testing in industry. The first of these problems has to do with the establishment of

a criterion on which to validate a test instrument. The second problem has to do with the apparent discrepancies that exist when one attempts to cross-validate a test on other related groups. These problems will be examined more closely within the framework of the more commonly used validation procedures employed by testing personnel in industry.

Concurrent validity, one of the commonly used validation procedures, uses as its validating standard the present job incumbents' performances. Sometimes concurrent validity assumes that all the present job incumbents are performing adequately. Under such circumstances the feedback of test score data will establish the test score distribution of the various job groupings. At other times the job incumbents' performances are rated at such levels as high, average, and low. Feedback in this case will establish the distribution of test scores within each job grouping. In either case the present job incumbents' performance on the tests as validated against a performance criterion are the basis for selecting future applicants for employment.

Concurrent validity has been criticized basically because the present incumbents do not form the same kind of group as do future job applicants. For one thing they probably have acquired or accumulated some kind of experience during their employment that would have some bearing on the test scores. These experiences would be denied the applicant. Moreover,

establishing concurrent validity takes time away from the job. Employees cannot perform their job duties while they are taking a test or test battery, and they are considered unproductive during the testing session.

Predictive validity, a less commonly used form of test validation, attempts to determine if a test "works" in a particular situation by administering it to all applicants seeking employment. The test results are not used in any way as the basis for selection in this case. Rather, the companies merely retain the test score of all those hired, and at some later date they perform a follow-up study to ascertain if a relationship exists between the employees' test scores at the time of their entrance into the company and their later performance in the company. Although less commonly used than concurrent validity, predictive validity has been accepted as superior, because the validated group is more likely to be representative of future applicants.

Predictive validity does have two major drawbacks. For one thing it takes more time to conduct than does concurrent validity, because there is a time lapse between the beginning of the research and the follow-up period. In addition a large portion of the original study is lost through attrition, a factor which could be more important at one time than at another. Presently in Chicago, an employer can expect a thirty percent turnover each year among shop employees. At other times this

figure could be higher or lower. It is conceivable that those who leave the company could have developed into the best workers. On the other hand they could have developed into the poorest workers. What is important is that the test is validated without really knowing what kind of people left the organization.

Both predictive and concurrent validation use as a criterion of success the rating of the supervisor. Herein lies the major drawback of these validation procedures. Studies have shown that supervisors' ratings are both inconsistent and biased, and also that for the same individual different ratings can be obtained from different supervisors. Mullins and Force (31) have described the problem of differences in raters, but they have also examined the possibility that the more accurate the raters are on one characteristic (as validated by an objective criterion such as test performance), the more accurate they will be in rating another unrelated characteristic. In other words, there is some indication to believe that some raters are objective and consistent from one situation to the other. But this is only an indication.

In addition to the inconsistency of supervisors' ratings there exists the problem of the "halo effect" and the tendency of many supervisors to rate most employees as average (the leniency tendency). Furthermore, supervisors often rate an employee consistently over a period of time even though the employee's performance changes.

Ebel (7) has made some relevant observations on validity that would seem to fit well any criticism of supervisors' ratings as an adequate criterion of test scores. He says:

> The ease with which test developers can be induced to accept as criterion measures quantitative data having the slightest appearance of relevance to the trait being measured is one of the scandals of psychometry. (7, 642)

He later continues:

> ....it makes little sense to judge the accuracy with which a test does the job it is supposed to do by checking the scores it yields against those obtained from a less accurate measuring procedure. (7, 644)
>
> ....the test developer pours all the skill, all the energy, and all the time he has into the process of making an outstanding test. He has none left over to spend on obtaining measurements "clearly superior" to those his test will yield, and under the circumstances would have no stomach for the task anyway. (7, 644)

Anastasi (2) has also made somewhat the same observation. She states:

> Although the very essence of psychological testing is the measurement of behavior, testing today is not adequately assimilating relevant developments from the science of behavior. The refinements of test construction have far outstripped the tester's understanding of the behavior the tests are designed to measure. I do not mean to belittle the value of these technical advances. Rather I would urge that the understanding of the behavior to be measured keep pace with the development of quantification techniques. (2,300)

Another problem inherent in using either concurrent or predictive validity as a validating tool lies in the fact that

jobs are not the same from one time to another in the same company, nor are they the same from company to company even when they carry the same title. This difference is the basic reason why cross-validation research produces varying degrees of validation coefficients. Jobs are constantly in a state of flux due to technology or job simplification. Perhaps it is recognition of this fact that has discouraged validation research on the part of industry.

Importance of the Problem

Few would argue that a company should use a published test that has not first been validated in the local situation. Yet, this is exactly what many companies are doing at the present time, and this is why many companies are coming under criticism from federal and union sources. These companies not only do not use concurrent or predictive validation in their test research procedures (if such procedures exist at all), but they arbitrarily establish cut-off scores on the basis of the test manual or on the recommendations of a consultant.

Related to this topic, French and Elbing (13) had this to say in regard to the future of testing and test validation in industry:

> A...personnel tool, employee testing, recently has come under considerable scrutiny and it appears that in the future those testing people who have not meticulously validated their tests for particular situations will come under in-

> creasingly heavy criticism. More and more cases pertaining to testing will go to arbitration, with the net effect of forcing both arbitrators and union officials to become informed and conversant about the use of tests. It is possible that a new professional journal will evolve as a clearing house for industrial testing problems, which will give a high percentage of its space to validation studies. A great deal of attention will also be given to the criterion problem. (13, 250)

Ebel (7) discusses the practice of using published norms and accepting published validation studies. He states:

> Validity, test theorists agree, is specific - specific to a given group of individuals tested, to the treatment given them, and to a given purpose for testing (or to a given criterion). Anyone who uses a published test is almost certain to give it to a different group than the one on which it was validated. For any user's group the test may be more or less valid than it was for the test author's tryout group. Quite possibly the user may even have a somewhat different purpose for testing than the author had in mind. His criterion may be different. Again this means that the test may be more or less valid than the author reported. Under these conditions, how can a test author possibly publish fully adequate data on validity? The best he can do is to report validity under certain clearly specified and carefully restricted conditions of use. For the majority of possible uses of a test, validation becomes inevitably a responsibility of the test user. There is thus an element of unfairness in the common complaint that test publishers fail to provide adequate data on validity. (7, 645)

In the 1960 *Labor Arbitration Reports* (22) a case is cited that went before an arbitration board because the union objected to the use of tests in selecting personnel for promotion. At that time the impartial arbitrator stated:

> Upon a challenge of the Company's determination through the Grievance Procedure in each particular case, Management has a duty to disclose the method and show the validity of tests that are used in making a determination and all of the test results should be made available to the Union. Although Supervisors' individual judgments as to the aptitudes and qualifications of an employee are a great weight in a proper determination, it should be the objective of both Parties to eliminate any possible personal prejudice through whatever objective testing criteria is possible. (22, 718)

A few more situations will be cited here to illustrate that validation, especially "good" validation such as synthetic validation, must be incorporated into the testing program of industry.

Guion (19) in a recent talk given before the Chicago Psychological Club stated that tests should first of all be based on a rational validity. Tests must be intrinsically related to the things being measured. This means that a thorough job analysis must be conducted before a test is used or developed, because test content and job content should be related, and the test should clearly correspond to the performance on the job.

Guion, who was assisting the Office of Federal Contracts Compliance (OFCC) to formulate guidelines for employee selection, stated in his talk that in the future the OFCC will want empirical evidence of test validation and will probably require subgroup (minority group) study. In fact, the author of this present study has recently become aware of a document in which the OFCC, in cooperation with the Equal Employment Opportunity

Commission (EEOC) requires a qualifying employer to file detailed information on the composition of the work force in all job categories (10). Another document (9) published by the EEOC asks for the following information on the tests given by a company: names of the tests, names of the testing agencies used, weight given to tests in the selection procedure, etc. In other words, the federal government is becoming increasingly concerned about tests used in industry.

It was probably the Motorola case of 1963 that caused a great deal of interest in testing (perhaps unduly so) on the part of the courts. This case has been well summarized by McLain, a participant in this study, in an article written for the *Personnel Journal* (30). This article also describes the Equal Employment Opportunity Commission's guidelines on testing under Title VII of the Civil Rights Act of 1964. These guidelines have to do with the employment testing procedures established for personnel departments. The basic requirement is that jobs must be examined so as to identify the skill requirements that are necessary for the successful performance of the job. Tests would then attempt to measure only these skills. This examination of jobs is done basically through job analysis.

In addition, the Commission will not only seek relevant (specific) job related tests, it will also inquire about test usage in terms of administration, validation, etc. The Commission could later require different cut-off scores for minority

groups for cases in which the test would be validated separately on members of a minority group. However, this seems contrary to acceptable standardization procedures in which the minority group would ordinarily be included as a stratified sample in the total norm group population in some predetermined ratio.

Description of Synthetic Validity

The concept of synthetic validity views a job as a combination of elements or factors. Each of these factors is present at a certain level in a job. The way in which the various factor levels are combined determines the differences among jobs.

Synthetic validity is the process of test validation that uses as the test criterional measures the various levels at which workers perform within any of the factors considered. Such factor levels are identified through job analysis and vary according to the job. The elements or factors of the job, and not the whole job, are related to the tests.

Thus, a worker who requires only a low degree (or level) of the factor under consideration will be expected to achieve a lower score of the related test as compared with that achieved by a worker who must possess a higher degree of the factor. By the same token, since the job that requires a low degree of one factor might require a high degree of another factor, the same worker would be expected to achieve a high score in the test that is related to the latter factor. Relevant test scores would

be correlated against each factor, and a combination of test scores, based on the job elements, would form a battery for a particular job.

Synthetic validity obviates the need to worry about the choice of criterion such as exists in concurrent and predictive validation. The success criterion, one of the most popular choices for concurrent and predictive validation, is determined frequently by supervisors' ratings, but it has no place in synthetic validity. The fact that a job entails a particular factor and that the level or degree of the factor can be obtained and quantified is sufficient for providing data to establish the validity of the test using the synthetic validity concept. This data is gathered through a more or less scientific approach (certainly a much more scientific approach than is found in supervisors' ratings).

Perhaps an example would illustrate the procedure. Assume that for a given group of related employees one is able to identify three or four factors that are common to all jobs in the group--problem-solving ability, accountability, and a contacts factor. Assume also that each job incumbent possesses some degree of each factor, but that the degree needed varies somewhat from one job to the other. If one were to assign four levels to each factor, Job *A* might require Level One of problem-solving ability, Level Three of contacts, and Level One of accountability. Job *B*, on the other hand, might require Level Two

of problem-solving, Level Three of contacts, and Level Four of accountability. Each job would have its own unique profile of factor degrees, but the factors would remain common to each one.

When tests are validated on the basis of factor levels, it is not necessary that individuals be selected in terms of their overall performance. All one has to do in order to validate a test is to select a composite of job incumbents who perform at Level One, for example, of the problem-solving factor. These incumbents could hold any one of a variety of jobs that differ quite significantly in job duties and specifications. The only thing the incumbents would have to have in common is that they do jobs which require the same degree of the level being validated. This process would continue for Level Two, Three, and Four of the problem-solving factor.

The four degrees or levels of the problem-solving factor could be defined as follows:

> First Degree: A problem is resolved based on established procedures and techniques. There is little need for ingenuity.
>
> Second Degree: A problem is resolved and action proposed within the context of a common field of learning. Decisions must be made as to alternate methods, and a degree of creativity not necessary in the first degree must be exercised at times.
>
> Third Degree: A problem is resolved based on one or more fields of learning. Considerable original thinking is necessary in choosing the methods and techniques to be used.

> Fourth Degree: A problem is resolved on the basis of a high degree of creative thinking and reasoning where there are few principles available to guide the course of action.

After one identifies the degrees of the factor, he next develops a test that apparently measures problem-solving ability and validates it on the job incumbents. What is necessary at this point is the selection of four samples of workers, each of which displays one of the four degrees of problem-solving ability. The samples are identified from an examination of the job analysis (or job evaluation) document, and each sample possesses a common degree of the factor. In any one of the samples there may be a variety of job incumbents (perhaps a technician, a tool and die maker, and a model maker), but the incumbents have a common degree of the factor.

If all of the subjects in each of the four employee samples were to take a problem-solving test, one could expect that the sample containing those who need and possess a higher degree of problem-solving in their jobs would score higher than the others on the relevant test. One could also expect the employee sample of third degree incumbents to perform less satisfactorily on the problem-solving test than those in the fourth degree sample, but more satisfactorily than those in the samples of the two lower degrees. The problem-solving test would be validated and predictive if there were a significant difference among the scores obtained by the present job incum-

bents in the various levels.

When a variety of relevant tests have been validated against the appropriate criteria (the factors and factor levels), it is possible to prepare a table of expectancies based on the test scores. One assumes, of course, that a test is relevant if it distinguishes between the various degrees of the factor. A battery of relevant tests can be assembled for each job if one knows the factors inherent in the job and the predetermined validities of the various tests.

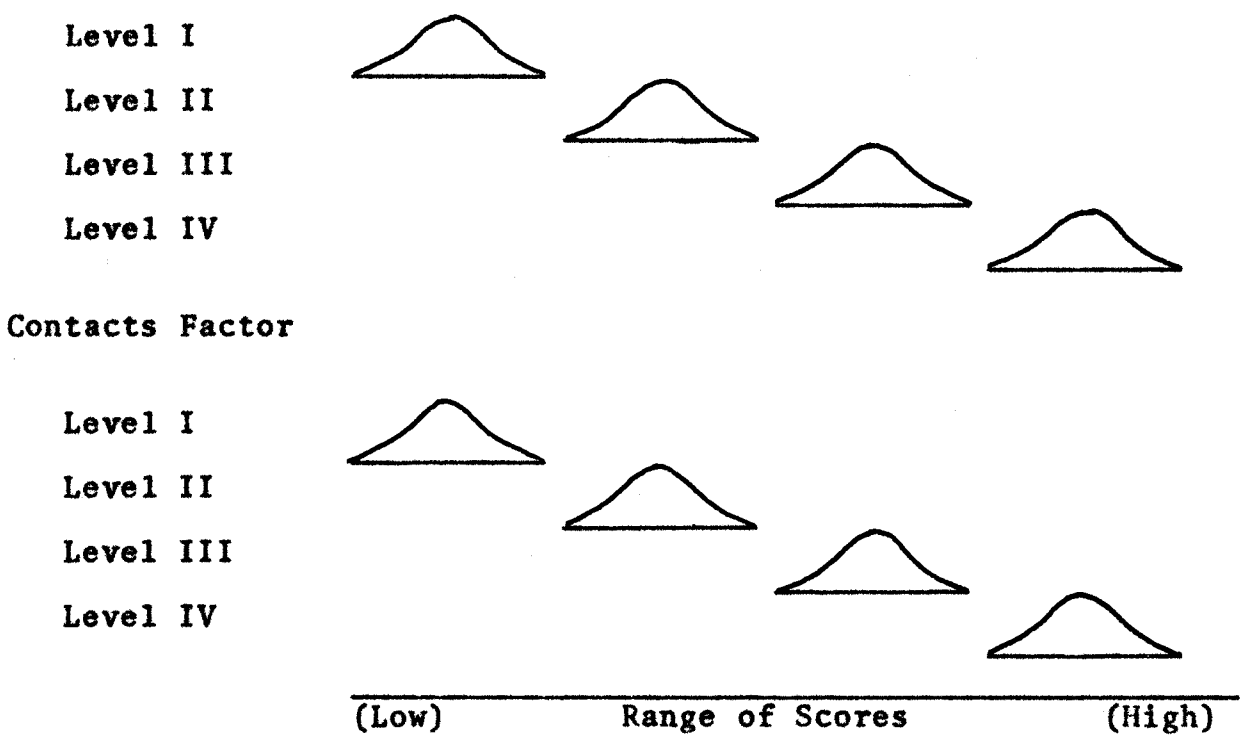
Returning to the former example of Job *A* and Job *B* mentioned earlier in this Chapter, one knows that Job *A* has one degree of problem-solving and Job *B* has two degrees of the same factor. Applicants for Job *A* would have to obtain a particular score of the problem-solving test in order to qualify for this factor, or at least to be similar to the current incumbents who work at Level One of problem-solving. This score was predetermined by validation between the test and the criterion--performance of present incumbents working at Level One of problem-solving. The test scores or the table of expectancies do not refer to any particular job; all they do is identify the factor and the predetermined valid test for the factor.

Table 1 illustrates the distribution of scores on the predetermined valid "factor" tests. The distributions of test scores for each factor level are significantly different from each other. There is a true difference among the levels via

the performance of the employees working at the various levels.

TABLE 1

A PROBLEM-SOLVING TEST DISTRIBUTION AND A CONTACTS TEST DISTRIBUTION OF SCORES BY JOB INCUMBENTS PERFORMING AT VARIOUS LEVELS OF THE FACTORS



The Problem-Solving Test and the Contacts Test were validated on the various levels of each factor. There was a significant difference among the scores obtained by the present incumbents on each test, depending upon their assigned levels as determined by job analysis.

What is apparent from the discussion so far is that nothing has been mentioned regarding a test being validated against a particular job. Emphasis is placed on the parts but never on the whole job, at least as far as the validation is concerned. This provides the tester with a most valuable document. Even as jobs change from time to time or new jobs are created, the validation research does not become obsolete. As long as common factors are retained (which is usually the case), test scores or expectancies can be used from the valid factor table to identify appropriate scores needed. Recall that one of the weaknesses of current validation practices in industry is that cross-validation is impossible within and between companies because of the changing nature of jobs. With synthetic validity a table of relevant test data on each factor is easily cross-validated, and higher validation coefficients could be expected between one sample group performing at Level One of Factor One, for example, and another separate sample performing at Level One of Factor One.

Synthetic validity also permits cross-validation of tests between companies, providing the factor and levels are the same (as they often are in similar industrial companies). In addition, tests validated in one company can be used in a smaller company that, because of its size and consequent small potential validating samples, could not validate tests within its own establishment.

Synthetic validity does away with the success criterion entirely. It assumes that those people who are presently on the job are performing adequately as a group, and no subjective rating is needed. Of course, the objection could be raised, as it is in concurrent validity, that applicants may not be the same type of group as the present incumbents. But this objection seems to be minimized when one considers that the jobs are broken down into their elemental parts and that samples are drawn not on the basis of total job but on the basis of factors only. A wide segment of jobs will constitute the sample; only the level and factor are common elements.

Development of Concepts Necessary for Synthetic Validation

Earlier it was mentioned that synthetic validity offered to the test user a more objective criterion on which to validate the test results. This objective criterion would replace the popular but unsatisfactory use of the success criterion based on supervisory ratings. The objective criterion used in synthetic validation is based on the factor levels which are identified by means of two scientific personnel approaches: job analysis and job evaluation.

Job Analysis. Job analysis is a systematic study of a specific job that not only specifies the duties but also interprets them in terms of characteristics necessary for successful performance. The job and not the individuals performing the

job are studied.

Job analysis uses a variety of techniques and involves a number of people; thus, the final written document has gone through a series of validating steps. Job analysis can be conducted directly or indirectly: The job analyst can look at workers performing on the job to determine what they actually do, or he can ask supervisors, foremen, and the job incumbents what kind of duties and skills are needed to perform the job. These observations and/or interviews are subject to a series of approaches, and in the case of some unionized companies, the union has the right to duplicate the analysis of the job analyst. Basically, what this checking and double-checking means is that the finished job analysis comes close to the objective truth (depending upon how it is conducted). This is especially important to synthetic validity, because validation of relevant tests is dependent upon how well the analyst can ascertain what workers performing a job are doing and what skills they must possess in order to perform the duties. It is also important that the job analysis be kept current so that, although the validation takes place at one time, cross-validation will be possible in the future.

Job analysis is oftentimes conducted on the basis of observing a sample of representative workers in a job. It is the author's contention that it might be feasible to administer the tests under consideration or study to the same employee

sample as that used for job analysis. This would exercise some control over the possible differences that could result from using two different samples--one sample for the criterion group and the other for the test data.

Job Family. Job analysis identifies those elements of a job that are similar to elements of other jobs. For example, the common elements of administrative jobs might be problem-solving, accountability, and contacts. For factory jobs the common elements or factors could be initiative and ingenuity, amount of supervision given, and responsibility for products and materials. This means that jobs having characteristics in common with other jobs can be grouped together into a cluster to form a job family. The only way that jobs within this job cluster differ is in the degree of each common factor or job element that is required. The controller would be expected to possess more of the problem-solving factor than, say, the cost accountant. And the director of public relations would need a higher level of contacts factor than the controller. Yet each job needs some degree of each factor.

The concept of job family is especially important for synthetic validation, because common factors or job elements must be identified as well as the level of each job on every separate factor.

Job Evaluation. Job evaluation is a process whereby the worth of a job in a job family is best determined by compar-

ing the job elements or factors of one job with the elements of other jobs in the job family or by comparing the factors with a predetermined scale. As in job analysis, the focus is upon the job and not upon the individual or individuals performing the job.

Job evaluation seems to be the most important single process for the development of synthetic validity. Although the literature has not focused on job evaluation (it has instead focused on job analysis), the author believes more weight and confidence can be placed in the job evaluation and its resulting document. This belief is established because of a number of reasons which came to light as the investigation proceeded.

1. Many companies do not develop an adequate job analysis program. Jobs are broadly described only within the context of a job evaluation program for a company.

2. Job evaluation and not job analysis (at least in the practical sense) identifies the factors within the job family. Job evaluation also identifies the levels within each factor. This is seldom done in job analysis.

3. Companies will often not write adequate job descriptions for job analyses, because the union members could more easily "grieve" if it were done.

4. Job evaluations are kept more current than job analyses, are subject to scrutiny, and are subject to audit.

5. Job evaluation easily lends itself to the criterion

measure for test validation.

Basically, jobs are evaluated using one of two methods, or in a few cases a combination of the two methods. Neither method, however, considers the job as a whole. Rather, each method breaks the job down into its elemental parts.

The first and most common method used is the point system of job evaluation which determines the common factors and the levels for each factor. A manual is prepared that describes the factors and their levels and, in addition, designates for each factor a point value that is distributed to each of the factor levels. This designation of points constitutes the loading of each factor in relation to the total job.

Figure 1 illustrates the procedure for evaluating two different jobs of a job family within the same company. Two factors are identified--problem-solving and contacts. Job *A* and Job *B* are shown as potentially having four degrees of each factor. Job *A* and Job *B*, which are represented as circles, overlap at Level (or Degree) One, because this fits the requirement of a job factor: in order for a factor to be used, there must be at least one degree in the job. When Job *A* was originally evaluated, three degrees of the problem-solving factor and two degrees of the contacts factor were present. Job *B* also had three degrees of the problem-solving factor, but it had three degrees of the contacts factor. If the jobs were evaluated for pay purposes on the basis of only these two factors, Job *B*

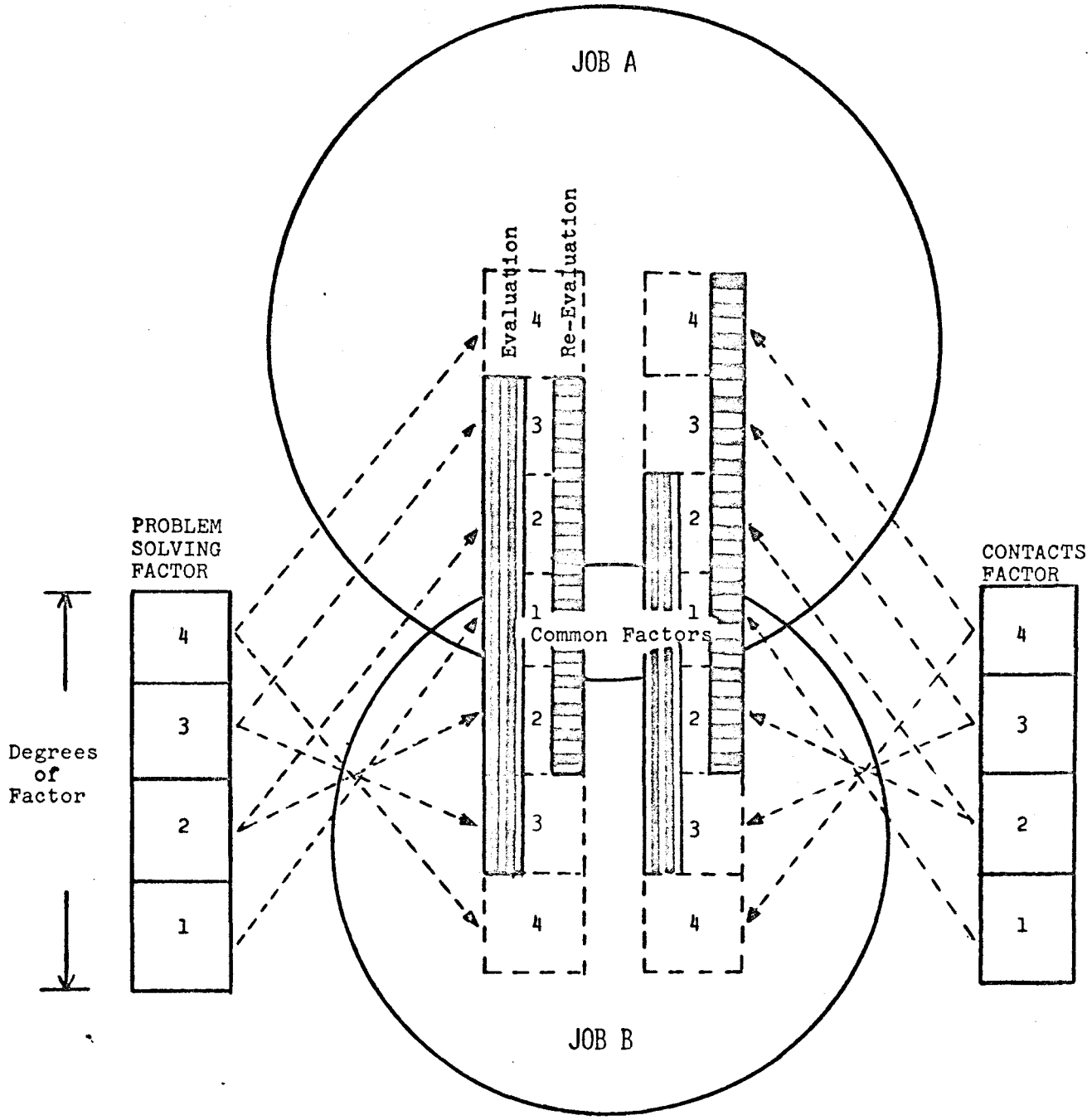


FIGURE 1. An evaluation of two jobs within a company. (Both Job A and Job B are members of the same job family and are evaluated on the basis of two factors, problem-solving and contacts.)

would be worth more than Job *A*, because Job *B* has a higher degree of the contacts factor, although it has the same degree level for the problem-solving factor.

This much information added to the knowledge of what jobs are at what level would make it considerably easier to conduct synthetic validation. Furthermore, cross-validation would result in higher validity coefficients.

Consider the later reevaluation of Job *A* and Job *B* again in Figure 1. Job *A* has been reevaluated at Level Three of problem-solving (the same number of levels as originally determined), but it has two more degrees of the contacts factor. Job *B*, on the other hand, has one degree less of both factors in the reevaluation. If at a later date one wanted a validation sample for the third degree of the problem-solving factor, he could use only Job *A*. Job *B* would need to be placed in the second degree sample, since the job was reevaluated downward in this particular factor. Failure to realize this fact is one of the reasons for the disappointing cross-validation studies.

The other less commonly used job evaluation system in industry is the factor comparison method. This is a rather elaborate system that basically rates workers on each common factor or job element in comparison with key jobs. This is primarily a ranking method by factor that does not identify degrees; consequently, it would not be useful for synthetic validity. Even when it is used in industry, it is usually

employed in a modified form that is combined with the point system.

Figure 2 illustrates the evaluation of two jobs that carry the same job title but exist in two companies, Company I and Company II. Job *A* in Company I is evaluated as needing three degrees of the problem-solving factor and four degrees of the contacts factor. The work under the same job title in Company II, however, is evaluated as needing two degrees of problem-solving ability and three degrees of the contacts factor. Re-evaluation would also reflect further changes. In Company I the original job evaluation for the problem-solving factor was revised from three degrees to two degrees, and in Company II the same factor was revised from two degrees to one degree. Similar changes also took place in the contacts factor.

Earlier it was stated that the changes and differences that exist in jobs carrying the same job title made cross-validation impossible. Synthetic validity, however, would consider the factor differences and give greater stability to the validation process because of its emphasis on the factor parts. The factors and factor levels constituting a job are constantly examined. However, synthetic validity would greatly depend on the extent to which job evaluation reflects what factors the workers possess and how frequently these evaluations are updated to consider job content changes.

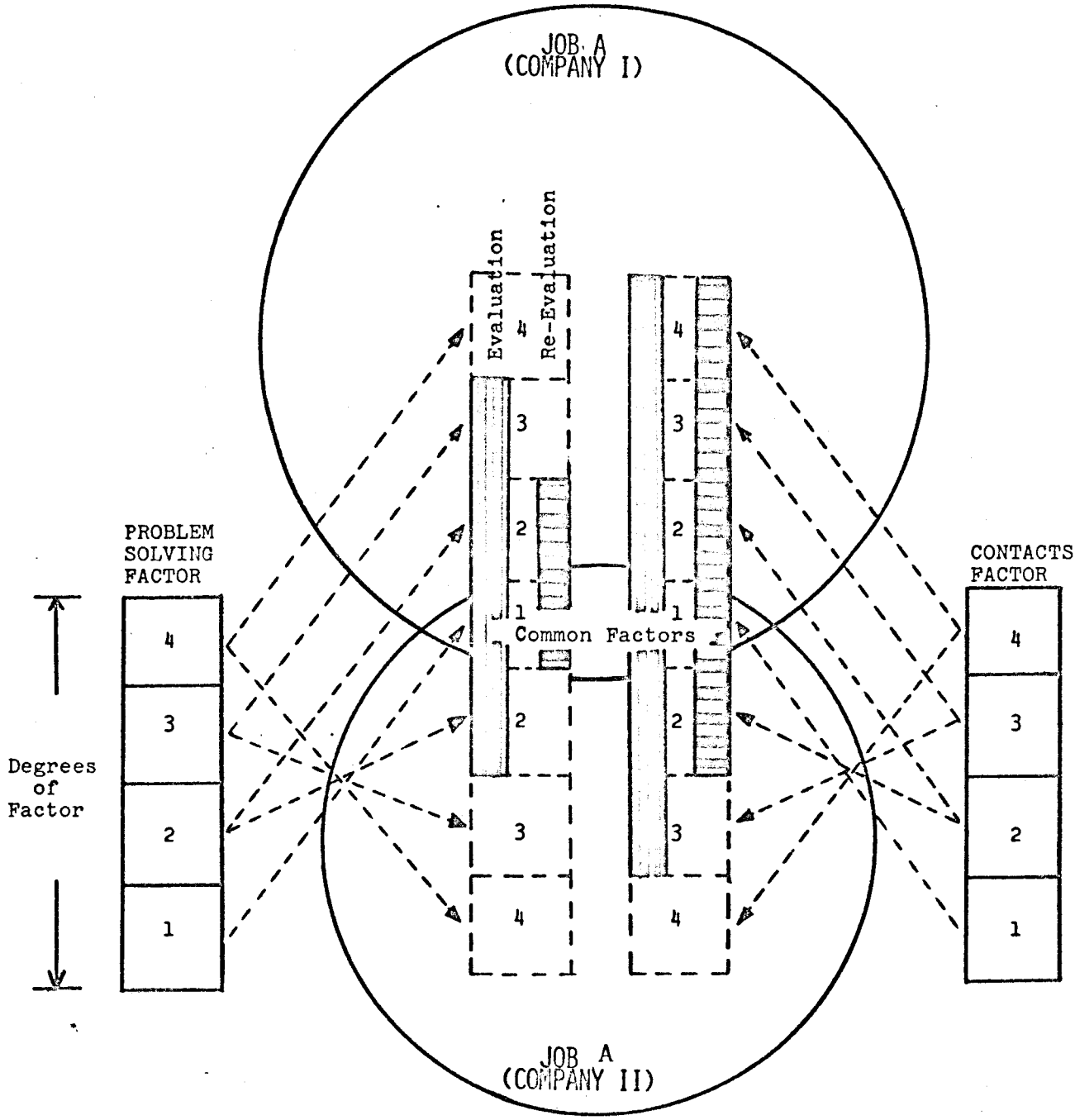


FIGURE 2. An evaluation of two jobs between two companies. (Job A in Company I and Company II has an identical job title. The job evaluation system is the same in both companies.)

Summary

This chapter has attempted to highlight the relative importance of the problem under investigation by showing how the introduction of synthetic validity would better serve the validation process. With synthetic validity the commonly used subjective, success criterion in a contemporary validation process is replaced by a more stable, objective criterion. This other criterion replacement is job factor with its job factor levels as they are identified through the accepted scientific procedures of job evaluation. Tests are selected that "fit" the factors, and the tests are validated on the basis of their ability to differentiate between the workers at each of the factor levels. Once a test is found to be valid for a particular factor, the valid test data can be utilized for newly created jobs or for changing jobs without the burden of having to re-validate a test instrument each time. Synthetic validity could also serve the needs of a smaller company which lacked numbers of employees on which to validate test instruments. As long as the smaller company had comparable factors and factor levels with other companies, the synthetic test data of the other companies could be used in the smaller organization.

The following chapter reviews the literature and the research on synthetic validation. Although there has not been a great deal of research conducted since the concept was formulated some fifteen years ago, the concept has functioned well

when tried out in a research setting.

CHAPTER II

REVIEW OF THE LITERATURE

Lawshe (25) was the first to formulate the concept of synthetic validity, and he and Steinberg (25) were the first to use it in an industrial setting. The original study of Lawshe and Steinberg (25) was conducted on a group of clerical workers, all of whom performed jobs in the same job family. They prepared job descriptions and then administered a clerical test to the job incumbents. Common job elements were identified and served as the criteria. The more critical were the common elements required of a job, the higher the test sub-score in that job element that was expected. If a sub-test was able to differentiate between levels of a job characteristic, it was retained.

The concept of job family is an important one in Lawshe's approach to synthetic validation. This concept refers to the process whereby the elements of a job that are identified through job analysis are grouped with like elements in other jobs. Those jobs with common elements are classified as belonging to the same job family and are different from jobs belonging to other groups. (23)

The original study of Lawshe and Steinberg (25) made

several assumptions, among which was that the amount of critical spelling operations that could be identified with a job analysis checklist on present clerical incumbents in a job family was directly proportional to the incumbents' performance on a clerical spelling sub-test. By the same token, the fewer but still critical spelling operations that could be identified would probably require less competent spellers, and consequently this group of workers would not be expected to do as well on the clerical spelling sub-test. Although the findings confirmed this assumption, the fact that the difference in critical operations or elements was a quantitative rather than a qualitative one would expose this study to some criticism. To perform a critical operation, one worker might need a higher degree of a factor than another worker who performed more critical operations of the same nature but who did not need as high a degree of the job factor required.

Balma (3) later delineated Lawshe's definition of synthetic validity and used the term to mean

> The inferring of validity in a specific situation from a logical analysis of jobs in their elements, a determination of test validity for these elements, and a combination of elemental validities into a whole. (3, 395)

Balma (3) realized that the whole job may not be equal to the sum of its parts (it may be greater), but he stated that synthetic validity seemed to be promising enough so that the risk of experimenting with the concept was well worth taking.

Balma (3) listed reasons to support synthetic validity, some of which are

1. There are too few people on a job to conduct a validation study.
2. There is insufficient time to do predictive validity studies, and employees and unions resist concurrent validation.
3. Job content changes at too rapid a rate.
4. New jobs are introduced at an increased rate.
5. There is a professional manpower shortage which precludes conducting validation studies.

Further evidence to support synthetic validation was given in interviews conducted with research and personnel directors in the Chicago area. Those interviewed indicated validation as the real problem of testing in industry, and stated that this lack of validity caused unions to be critical of testing. It was further stated that frequently not enough is known about the job being validated. Yoder (39) and French (12) also discussed union reaction to testing.

Ghiselli (14) did an extensive survey of validity and discovered great variation in findings concerning a particular test as applied to workers on a particular job. He believes that the main cause of the variation stems from (1) the differences in the proficiency criteria used on the same job by different establishments, and (2) the differences in duties for

a particular job in different establishments.

Ghiselli (14) accused the industrial psychologist of being too global in test validation--predicting overall success. He states:

> We need to be far more analytic. Perhaps we should break down jobs into specific tasks or functions and try to understand them. If we could isolate job functions, we could study their interrelationships and their predictability separately. With this information we could synthesize tests into reasonable predicting devices with substantial consistency from job to job. (14, 401)

This is what synthetic validity does!

It was also Ghiselli (15) who has criticized the present use of criterional measures in selection. Like Anastasi (2) and Ebel (7), Ghiselli states: "It is certainly true that far more attention has been devoted to the development of predictive devices than to the understanding and evaluation of criteria." (15, 197) He identifies three problems in relation to criteria that involve worker proficiency. First, workers' proficiency cannot be described by a single dimension. Second, job proficiency or job success may not be constant over a period of time. It could develop irregularly or level-off at a particular point in time. And third, Ghiselli states that workers who carry the same job title and supposedly perform the same job duties may not, in fact, do so on a practical level. Both workers could be successful on the job, but each does so in a unique manner. One worker could be more productive than the

other, but the other could be one who helps develop a spirit of cooperation in the work group. Both workers are valuable to the organization, but each in a different way.

In order to isolate the job functions or elements as described by Ghiselli, it becomes necessary to conduct job analysis. Dunnette and Kirchner (6) described the importance of conducting and using job analysis for personnel procedures and emphasized the fact that job analysis must not only describe job duties, but it must focus upon those behaviors which would make the difference between success and failure on the job. They discussed many of the shortcomings of conducting job analysis and supported the testing approach that first of all determines the job measurement (or element) through job analysis, interprets the job measurements in terms of the successful behaviors, and relates these behaviors to measurement instruments. Their selection model is based on these concepts.

The Personnel Policies Forum of the Bureau of National Affairs (33 and 34) discovered that although ninety percent of all companies represented in the forum do conduct testing programs, only thirty-five percent use the job analysis in such programs. Synthetic validity would require all of the companies to use the job analysis, thus requiring greater cooperation between the job analyst and the testing personnel.

Following Dunnette and Kirchner's suggestion (6) that a single battery of tests cannot be used in a company where

workers must perform quite different duties, Peterson (36) attempted to identify the homogeneous factors of the heterogeneous work group. Two dominant judged factors were identified in the heterogeneous work group, and the workers possessing one or the other of these factors were segregated. Test scores were then correlated with a success criterion. More significant correlation resulted between the criterion and sub-groups than between the criterion and the total heterogeneous group as shown below.

	Total Group N=106	Reasoning Group N=57	Routine Group N=49
Thurstone Test of Mental Alertness	.29	.38	.11

It should be noted that Peterson did identify a success criterion in his use of sub-groups for validation purposes. And this success criterion is the very thing that Lawshe (25) wanted to exclude in his validation concept. However, Peterson's study (36) is cited here as a variation of the original model.

Returning to Dunnette and Kirchner's (6) stress on the importance of conducting job analysis, McCormick (29) discussed the different types of job analyses that can be conducted and proceeded to evaluate each in terms of its contribution to synthetic validity. He stated:

> The crux of our ability to establish adequate indirect validity for jobs depends basically upon our abilities to identify, through job

> analysis procedures, the job ingredients which can serve as common denominators... (29, 412)

Fine (11) has developed a useful concept for identifying common factors or denominators between jobs. His concept of functional job analysis (FJA) establishes various factor hierarchies, and any job being analyzed can be done so at some level of each hierarchy.

Guion (17) completed a synthetic validity study in a small wholesale and retail company, using a battery of five tests which he administered to all personnel in the organization. Before the battery was given, however, each position was analyzed and seven job elements were identified. Each position included one or more of the job elements. Performance ratings were then made on each position so as to establish the criterion.

The test scores were then compared with the high and low criterion groups and where a significant difference was established, the test was retained as being predictive. For every criterion category the two best predictors were identified through multiple correlation.

Guion (17) deviated from Lawshe's original concept (25) in two ways. First of all, like Peterson (36), he chose to identify a success criterion in each group. Secondly, he did not have a job family, since there were no common elements that could be identified in every position. A job family requires that each job within the job family must have some degree of

each selected job element.

Primoff (37) has developed a concept called the J-Coefficient which uses the synthetic validity approach to test validation. The J-Coefficient (the J referring to job analysis) is an index between a job element and a test, and is used by the United States Civil Service Commission in its examination program.

With the J-Coefficient a group of raters who are familiar with job requirements first identify elements in the job and then rate each element on a three point scale: a plus means the element is very important to the job, a check means that it is moderately important to the job, and a zero means it is not important at all. "A basic principle in J-coefficient theory is: the stronger a job requirement, the more people will recognize its importance." (37, 36)

In addition to the job analysis, Civil Service tests with test values are chosen that have been sufficiently validated. The correct test values of these tests are determined through extensive research and they reflect the degrees that job elements are reflected in the test. "...these values help determine how useful the test will be for a particular job that has been analyzed in terms of elements." (37, 37)

> Correct test values are weights that will result in equal J-coefficients and validity coefficients. The technicians first make an estimate of proper values on each element

for a test, on the basis of their knowledge of previous test results. Then, the test values are revised through the application of results of validation studies. In these studies, both J-coefficients and validity coefficients are found for the same tests and the same jobs. The J-coefficients and validity coefficients are compared, and the test values are corrected so that the J-coefficients come to agree more and more with true validity coefficients. (37, 38)

.....

Since the J-coefficient is an estimate of the validity coefficient, certain comparisons between the J-coefficient and the validity coefficient may be made.

For the validity coefficient, we get ratings in relative job proficiency for the people who work at a job. Their ratings are then compared to their test scores. For the J-coefficient, we get ratings of relative importance of job elements for people who work at a job. The ratings are compared to test values. (37, 39)

CHAPTER III

PROCEDURE

The Electronics Personnel Association

The electronics industry is one of the most important industries of the Chicagoland area, and because the author was familiar with a number of people in it, he decided to concentrate in this industry. On September 8, 1967, the author met with the Director of Industrial Relations and the Personnel Director of Standard Kollsman Industries, Inc. to discuss his research proposal and to enlist their aid in obtaining the cooperation of as many electronics firms as possible as sources of data. The Director of Industrial Relations was a past president of the Electronics Personnel Association (EPA), and he had previously agreed to assist in the development of the study. At this meeting it was decided to schedule the author as a speaker at the September EPA meeting so that he could explain the nature of the study to member organizations and to seek their cooperation.

The Electronics Personnel Association is an organization of personnel and industrial relations people in the Chicago area. Most of the electronics companies are represented in the organization. There are sixty-seven member companies, sixty-two

of which are in the immediate Chicago area, five of which are located out of the state. Of the sixty-two located in the Chicago area, only fifty were of sufficient size to warrant study. The remaining twelve had fewer than 250 employees and thus could not have meaningful job families or significant job factors.

The fifty companies chosen for participation in the study were classified according to the number of employees they had. Forty-two percent of the fifty companies had more than 1,000 employees each, thirty-six percent had between 500 and 1,000 employees each, and twenty-two percent had between 250 and 500 employees each according to the 1966 publication of the Chicago Association of Commerce and Industry's *Major Employers, Metropolitan Chicago.*

Twenty minutes before the Electronics Personnel Association September meeting was to begin, the author was refused permission to speak before the group as planned, because the president of the organization objected on the grounds that the proposed study had not been submitted to the executive council prior to the meeting. The Personnel Director of Standard Kollsman Industries, Inc. was advised, however, that if his company would sponsor the study, he could, as a representative of a member company of the Electronics Personnel Association, introduce the author, discuss the study, and ask cooperation from the other members. This he agreed to do. At the end of

the meeting representatives from a number of member companies agreed to participate in the study. The author asked each of these companies for an interview that would cover personnel practices in regard to job analysis, job evaluation, and the current testing program in the shop area. The other companies not represented at the September meeting were to be solicited later by telephone as a means of obtaining their cooperation.

The Questionnaire

A questionnaire was developed that would guide the structured interview. There were three major areas to be covered--the company's job analysis program, the job evaluation program, and the current testing program as each exists in the production area. In addition, four key shop jobs common to all electronics companies were selected for special study as a means of determining the differences that exist from one company to the other. This special study would serve as a basis for job comparison.

Table 2 lists the questions that were covered in each interview. Each question was designed to evaluate some aspect of the personnel practices in the electronics companies that is important to the concept of synthetic validation.

The first eight questions have to do with job analysis. Job analysis forms the framework for the use of synthetic validation (although in practice this does not seem to be necessarily

TABLE 2

QUESTIONS GUIDING THE INTERVIEWS OF ELECTRONICS COMPANIES

Part One

1. Are job analyses prepared for the employees and, if so, how are they prepared?
   Are they updated to reflect job content changes?
   If unionized, what role do unions play in job analysis, and how do they react to job content changes?

2. Are the job analyses broken down into factor specifications necessary to perform the job duties?

3. Who is the job analyst? Who is in charge of the testing program?
   What is the relationship between the job analyst and the testing personnel?

4. Could tests be validated on the same group of employees that comprise the job analysis sample, if there is such a sample?

5. Are the job analyses prepared on the basis that the current group of employees are performing adequately?

6. Are the job analyses written in essay or checklist form?

7. Are the job specifications inflated?

8. Are the job analyses written as the jobs are performed or as the jobs ought to be performed?

Part Two

9. Describe the job evaluation system.
   Do the job evaluations reflect changes in the job analyses?
   Is a ranking method or a classification method used in preparing job evaluations?
   Is there a union representative on the job evaluation committee?

10. Are the factors identified in the job analysis retained in the job evaluations?

TABLE 2--Continued

Part Three

11. What tests are used to select employees?
How are these tests selected?
Are the selected tests related to job specifications?
What kind of validation studies are conducted?
How often are the validation studies conducted?

12. Will the same test or battery of tests be used for jobs that are similar but not necessarily identical, and that are possibly located in different departments?

13. Describe the kind of research conducted for your testing program.

14. Do the supervisors see the test results?

15. Is the company favorable toward testing its present employees for research purposes?

16. Is a success criterion utilized in test validation? If so, how is the criterion determined?

17. If predictive test validation research is conducted on new employees, how are those employees in the original study treated who have left the firm before the follow-up can be determined?

the case). These questions attempted to discover the similarities and differences between electronics companies writing of job descriptions for job analysis and also how well the descriptions actually reflect what workers do. In other words, are the job analyses "valid" and do they interpret the job duties into worker specifications that are necessary to perform the job. One important facet of this area lies in the number of people who are involved in conducting job analysis. Certainly the "truth" is better reflected in a situation involving conflicting interest groups: for example, management and union. Each group would be a check on the other. This first series of questions was also designed to determine if it is feasible to use the same job analysis work sample for the sample needed in test validation.

The second series of questions (Part Two) has to do with the job evaluation system developed and used in each participating company. The author originally felt that the evaluations would be more useful in conducting synthetic validity, because more emphasis seemed to be placed on evaluation than on analysis. Again, the author sought to determine areas of commonality among companies as well as to determine the degree to which the evaluations represented a consensus of opinion within the same company as to the authenticity of the completed job evaluations. There was also an attempt to determine how current these job evaluations were, how often they were updated, and if

there was a direct relationship between the analysis and the evaluation.

The third series of questions (Part Three) concerns the status of testing in each company. Of particular importance for purposes of this study was the gathering of information on the methods and types of validation studies that are conducted in industry and the discovery of how these companies choose tests for employee selection. It was of particular interest to this study to discover if these tests were relevant to the jobs, or, in other words, if they were tied in with job factors or job specifications.

Company Participants

Of the fifty companies elegible for participation in the study, forty-four granted the author personal interviews. These interviews were usually conducted with the director of industrial relations, the wage and salary administrator, or the personnel director. The choice of one or the other was dependent on the designation of the Electronics Personnel Association membership list. This membership list indicated who in the company should be contacted regarding personnel information for survey purposes.

The interviews were scheduled between the end of October, 1967, and February 6, 1968. These interviews, which generally took place at the plant site, usually lasted from

one-half hour to two hours, depending on the size and procedures of the company. Each of the participating companies with very few exceptions, expressed an interest in the study and was willing to cooperate. The six companies which did not participate chose to do so because of the following reasons:

1. One company declared bankruptcy, and another closed its operations in the Chicago area and moved to another state.
2. One company was without a director of industrial relations during the period of the study.
3. The remaining three companies had personnel change during the survey, and the new incumbents felt reluctant to give out information based on their short experience in the new position.

Table 3 lists the names of the forty-four participants. The Elgin Radio Division had been misclassified as a large size company, or one which employs more than 1,000 workers. In reality this company has fewer than 100 people. Thus, this company, although having granted an interview and participated in the study, will be omitted from the rest of this report except for its inclusion in Figure 3.

Figures 3 and 4 indicate the locations of the participating companies. The maps usually indicate the corporate headquarters if more than one plant is located in the Chicago metropolitan area. This location was the visitation site for

TABLE 3

FORTY-FOUR PARTICIPATING ELECTRONICS COMPANIES

Admiral Corporation	Motorola, Inc.
Advance Transformer Company	National Video Corporation
Amphenol Corporation	Nuclear-Chicago Corp.
Automatic Electric Company	Oak Manufacturing Co.
Belltone Electronics Corp.	Ohmite Manufacturing Co.
Chicago Aerial Industries	Quam-Nichols Company
Cinch Manufacturing Co.	Radio Materials Co., Div.
C.P. Clare and Company	Rauland-Borg Corporation
Controls Co. of America	The Rauland Corporation
Cook Electric Company	Rock-Ola Mfg. Corporation
Croname, Inc.	The Seeburg Corporation
DuKane Corporation	Shure Brothers, Inc.
Elgin Radio Division	Simpson Electric Co.
Guardian Electric Mfg. Co.	Sola Electric Company
The Hallicrafters Company	Standard Kollsman Indus., Inc.
Hammond Organ Company	Stewart-Warner Corporation
Knowles Electronics, Inc.	Stewart-Warner Electronics
Littelfuse, Inc.	Sun Electric Corp.
The Mercoid Corporation	T.R.W. Electronic
Methode Electronics, Inc.	Vapor Corporation
Microdyne, Inc.	Wells-Gardner Electronics
Mid-West Coil and Transf. Co.	Zenith Radio Corporation

the interview.

Figure 3 shows the twenty-three companies (including Elgin Radio Division) who participated within the city of Chicago. The companies could be divided by employee size as follows:

Number of Employees	Number of Companies
Over 1,000	11
500 to 1,000	6
250 to 500	5
Less than 50	1

Figure 4 indicates the companies located in the metropolitan area of Chicago but outside the city of Chicago. This includes plants as distant as St. Charles and Crystal Lake. The twenty-one companies indicated on this map could be distributed by employee size as follows:

Number of Employees	Number of Companies
Over 1,000	7
500 to 1,000	11
250 to 500	3

Combining all electronics companies in the Chicago metropolitan area participating in the study, there were eighteen large companies (1,000 employees and over), seventeen medium-sized companies (500 to 1,000 employees), and eight smaller-sized companies (250 to 500 employees).

Job Comparisons

One of the purposes of the study was to ascertain the degree to which jobs having the same job title would differ in

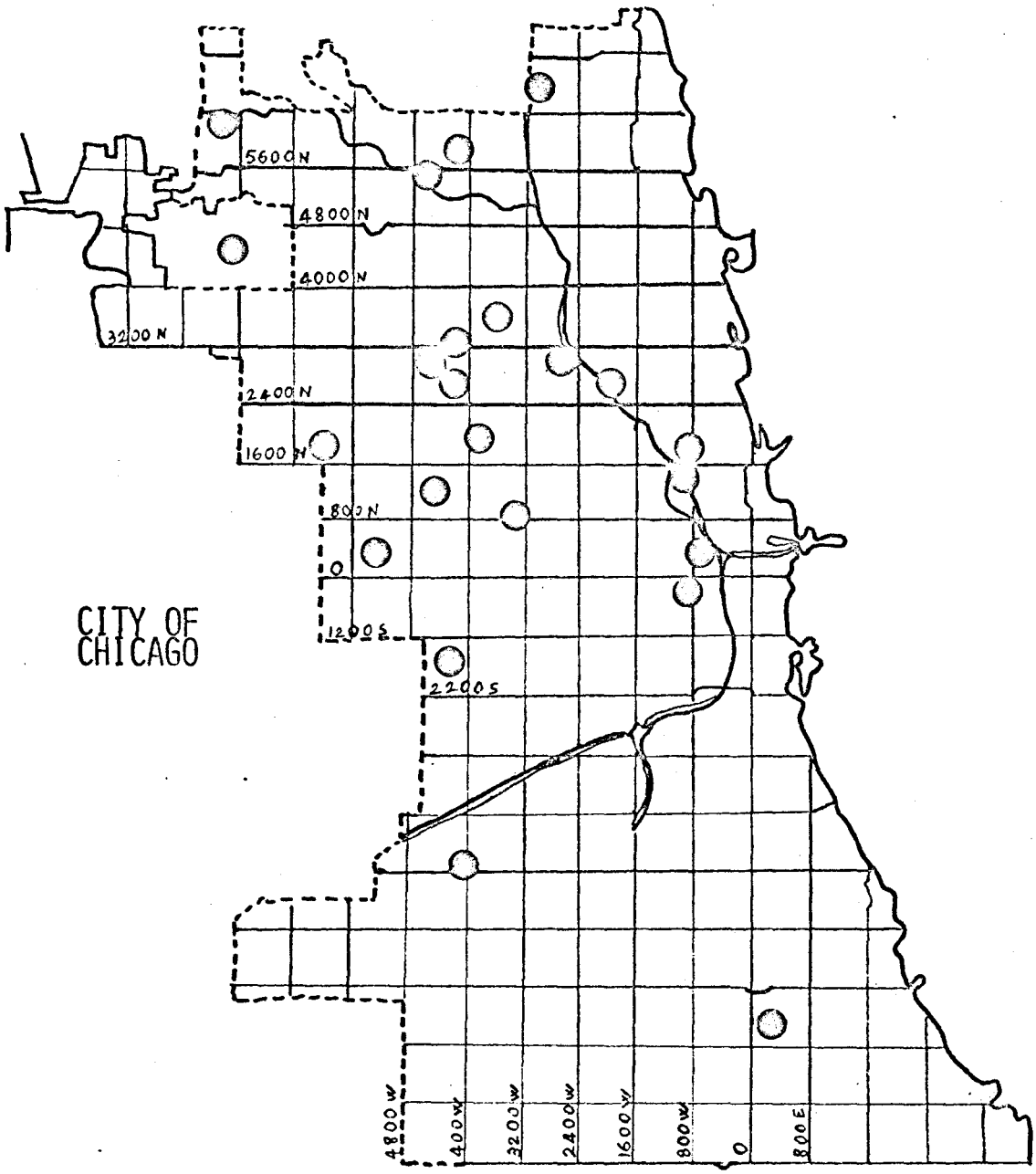


FIGURE 3. Twenty-three electronics company participants in the City of Chicago. (Each dot represents one company location.)

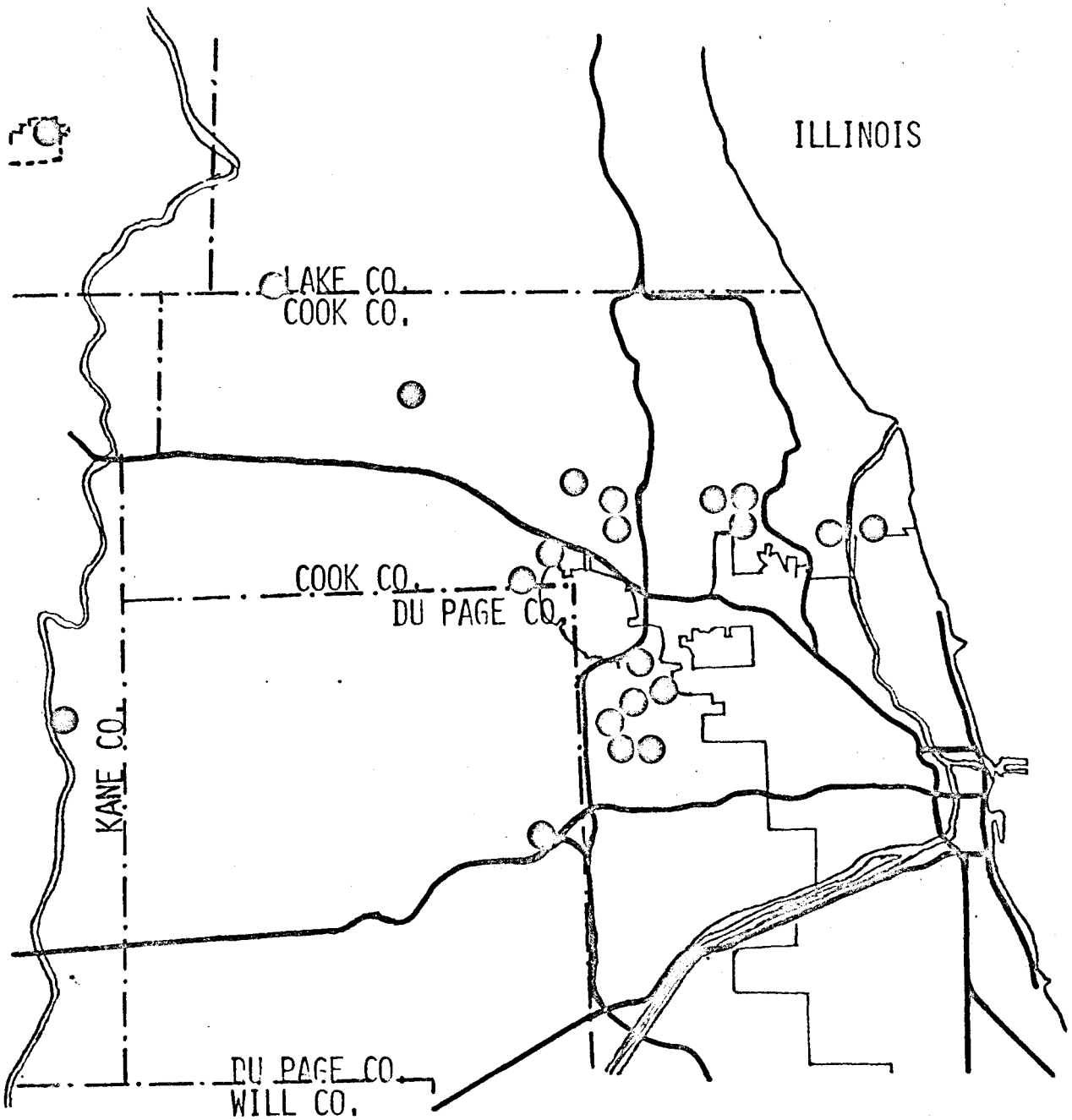


FIGURE 4. Twenty-one electronics company participants in the Chicago metropolitan area outside the City of Chicago. (Each dot represents one company location.)

duties and specifications within an industry. For comparative purposes four jobs were chosen that were common to most companies in the electronics industry: assembler "C", inspector "B", drill press operator "C", and shipping clerk. All companies in the study have definitions for these jobs as they are taken from the *EPA Wage Survey* manual, and every member has a copy of this manual.

These jobs are defined by the manual as follows:

ASSEMBLER "C" (Line or light assembler)

Work is highly repetitive and is performed on a conveyorized or moving line. Uses pliers, screwdrivers, air guns to assemble or install light parts such as knobs, dials, sockets, tubes, tube shields, shafts, brackets, antenna assemblies and similar items. A female job. (8, 1)

INSPECTOR "B" (Line Inspector, Chassis Inspector)

Work is repetitive and is generally performed on a conveyorized or moving line. Works from schematics or color charts. Inspects for correct assembly, lacing, soldering. Must be familiar with proper soldering connections and know color codes of components. May use electric meters or oscilloscope to check continuity, resistance, voltage. (8, 3)

DRILL PRESS OPERATOR "C"

Highly repetitive work. Light simple drilling on small bench or floor machines. Small variety of work, usually a single operation requiring only ordinary accuracy. Simple jig work or burring operations. (8, 2)

SHIPPING CLERK

Makes out bills of lading, express and parcel

post bills and local delivery receipts. Notifies truck lines of pickups, routes all shipments. Checks all orders to verify that all items to be shipped have been checked. Not a supervisor. If salaried, convert weekly rate to hourly rate. (8, 7)

Jobs were to be compared on the basis of the National Metal Trades Association (NMTA) job evaluation factors. These factors are in common use in electronics companies, and their use would be a means of comparing jobs from one company to another since the factors and factor levels do not vary. When evaluating a job, a company assigns a particular degree to each factor. These factor levels for each factor would then be averaged for purposes of the study for those companies having jobs that fit the descriptions and using the National Metal Trades Association format. Variance for each factor level would be determined.

CHAPTER IV

RESULTS

Part I

Question Number One

Companies with Job Analyses. The first question in the interview is concerned with the nature of job analyses in each company: how are they written, who approves them, are they up-dated, and who initiates a job description change. In response to the question: Do you have written job descriptions for your shop workers and are they current? the participants gave a variety of responses. Table 4 indicates how the responses were distributed among the forty-three companies. Most large size companies had current job analyses conducted and written for production jobs in the shop area. Of the four larger-sized companies that had no job descriptions, two companies, Company 192* and Company 191 had combined the job analyses and the job evaluation program: rather than have two separate documents,

*Companies are not identified by name in the report. Each company has been assigned a three digit number; the last digit indicates the size of the company: one for large, two for medium, and three for small.

TABLE 4

COMPANIES HAVING WRITTEN JOB DESCRIPTIONS

Response Categories	All Cos.	Company Size* A	B	C
Yes:				
Current	19	11	4	4
Dated	6	2	3	1
No	13	4	6	3
In Process	5	1	4	0
Totals	43	18	17	8

*A refers to the large size companies (over 1,000 employees), B refers to the medium size companies (500 to 1,000 employees), and C refers to small size companies (less than 500 employees).

both the analyses and evaluations are shown on the same document, and both functions were prepared at the same time. At Company 051 job descriptions, as a single and discrete function, were avoided because such descriptions would limit the performance of the worker.

Company 271 had no written job descriptions because of the union activity at the plant. To conduct a job analysis program would mean that the union could participate in the activity, and this the company wanted to avoid.

Six medium size companies had no job analyses that described the duties of the shop workers. One company, Company 172, felt that job duties change too rapidly for the description to serve any purpose. Another, Company 142, had no job descrip-

tions, but standards were established by time study on plant operations. The remaining companies, Company 222, Company 242, Company 252, and Company 302, combined the job analyses and job evaluations into the same procedure, but rather than identify job duties in total for each job, they describe the duties on a factor basis. In other words, common factors were first identified and then a description was written to "fit" each factor. In most cases the National Metal Trades Association (NMTA) job evaluation format was used with its accompanying eleven factors.

Three of the small size companies had no written job descriptions. Company 043 and Company 113 stated that most of the shop jobs were not skilled and the requirements for such jobs were quite low. Company 333, much like Company 043, said that the workers are quite flexible and they are able to move easily from one job to another. This means that a group of workers can be covered by the same job title, but they may not necessarily perform the same kind of duties.

Method of Conducting Job Analyses. In response to the question regarding the method of conducting job analyses, a variety of measures was mentioned by the thirty respondents who conducted or were in the process of conducting job analyses. Basically, the analyses were completed using the direct or indirect method, and the results are shown in Table 5. By a direct method of job analyses is meant that the worker is

observed by someone who is trained in gathering data through scientific observation. This observer should not be a supervisor or foreman. By the indirect method, the second method of conducting job analyses, data on a job would be gathered by means of interviews and questionnaires. The direct method is often combined with the indirect method.

TABLE 5

THE METHOD OF CONDUCTING JOB ANALYSES

Response Categories	All Cos.	Company Size A	B	C
Direct Method	5	4	1	0
Indirect Method	14	6	6	2
D/K or Insufficient Info.	11	4	4	3
Totals	30	14	11	5

Many of the individuals interviewed did not know how the descriptions were written since the job analyses had been conducted before their employment with the company. One company, Company 231, had descriptions that were written thirty years ago, and they are still being used. Another company, Company 203, did not identify the original method of job analysis, but the current job analyses are written using the indirect approach. Company 441, one of the large size companies classified as using the indirect method, would also use the

direct method if it were found necessary to do so, but the direct method was not the main source of analysis.

Company 022, a medium size company, is in the process of conducting job analyses. It has not decided on the procedure to be used, but an industrial engineer in the company is exploring methods and techniques.

The only medium size company to use the direct method, Company 392, does so because the shop workers are on an incentive program, and it is necessary that the job descriptions reflect what the workers actually do. These descriptions are written by the industrial engineering department and involve time and motion study.

Only very few companies used a sample of workers when they conducted job observations. Industrial engineers, when assigned the responsibility for writing job analyses, were the most apt to use a sample to study the job. In only one other company (Company 261), where the job analyses were not done by an industrial engineer, did a type of sample study take place that was somewhat unusual. Each job in the shop of Company 261 was observed and detail gathered. Then each person performing the job was interviewed, and if a worker stated he was doing the same things as another worker who had been interviewed previously, then that worker would be by-passed for purposes of the study. Each person in the shop was checked out in this manner and a 100 percent audit was performed.

One large company, Company 311, stated that samples are not random because of the repetitive nature of the production workers.

Individual Who Conducts Job Analysis. The next major part of Question Number One had to do with the identity of the individual who was basically responsible for writing the job descriptions and specifications. Table 6 summarizes the results. The category of job analyst includes full-time analysts as well as persons in other positions in the personnel field that have as one of their functions the performance of job analysis.

TABLE 6

INDIVIDUALS WHO CONDUCT JOB ANALYSES

Response Categories	All Cos.	Company Size A	B	C
Industrial Engineer	2	1	1	0
Job Analyst*	10	8	1	1
Consultant	5	1	3	1
Supervisor	2	1	1	0
Plant Manager	1	0	1	0
N/A or Insufficient Info.	10	3	4	3
Totals	30	14	11	5

*Includes personnel director, wage and salary administrator, personnel manager, a three member job analyses committee and a compensation representative.

Although a consultant had been used by Company 341 of

the large size companies in the original job analysis program, the job of updating the documents or writing new analyses would be delegated to the job analyst with approval from a committee.

Of the three large size companies in the N/A or Insufficient Information category, two companies did not know who was basically responsible for the writing of the job analyses because of the age of the descriptions. In Company 181 the descriptions are nine years old and they have not been updated. The person interviewed was relatively new to the job and he was not able to state who did the analyses. In Company 231 the descriptions are thirty years old.

Of the three medium size companies listed in Table 6 using the services of consultants, Company 412 and Company 352 did so only for the initial program. Revisions would be taken care of by a member of personnel.

Company 022 is in the N/A category because it is in the process of having the analyses done, and the company is not certain who will do the job in the future when it needed to be done. Another medium size company, Company 162, is in the N/A or Insufficient Information category, but the director of industrial relations who "inherited" the original descriptions is currently rewriting the analyses.

Company 203 is placed in the N/A category. However, current analyses are conducted by the factory manager.

Recall that in Table 4 there were six companies in the middle size range that did not have job analyses written. Of these six, five combined the job evaluation and the job analyses. In so doing, the analyses served a very limited purpose, that of determining the worth of each job for pay purposes. There was usually only one document and the combined analyses and evaluations were done in such a manner that common factors would first be identified and then a description written to fit each factor.

Use of Committees in Preparing Job Analyses. For purposes of this question, committee was defined as a group of employees in the organization working together as equals on a job analysis program. Each member of the committee would have equal approval power.

The question attempted to probe the number of people involved in approving job descriptions after they had been written. This committee could be an informal or formal entity and would include any employee participation other than the union. In a union plant the agreed-on descriptions by members of a company would usually constitute a bargainable item at contract time. Table 7 summarizes the responses of the thirty companies having job analysis programs.

TABLE 7

USE OF COMMITTEES IN PREPARING JOB ANALYSES

Response Categories	All Cos.	Company Size A	B	C
Committees:				
Formal	1	1	0	0
Modified Formal	1	1	0	0
Informal	6	3	3	0
None	13	6	4	3
Insufficient Information or Job Analysis in Preliminary Phase	3	1	1	1
N/A	6	2	3	1
Totals	30	14	11	5

The N/A category refers to the dated descriptions of Company 231, Company 282, Company 382, Company 181, Company 092, and the descriptions of Company 083 which were brought in from another company.

Only one large size company, Company 261, had a formal type committee that involved the assistant production manager, the manager of standards and methods, and the compensation and safety administrator. Job analysis engaged this committee full-time, and two-thirds agreement was required on each description. The modified formal committee in Company 341 lacked a formal identity, but approval was required from the majority of the members.

The majority of the companies having an informal committee had one which basically consisted of a department supervisor, a member from the personnel department, and the plant manager. These informal committees acted more in the capacity of an advising unit with each member helping "round out" the descriptions.

Two large companies, Company 311 and Company 321, were listed in Table 7 as having no job analysis committee. However, both these companies had formal type programs that involved a great deal of union participation. The job analysis procedure for these companies is discussed below at some length since the procedure is the most detailed of all the electronics companies.

In these companies, the job analyst basically uses the "on the job interview" technique and observation. The interview and observation is done directly with the worker using a job study sheet. Questionnaires are not sent to workers or supervisors because the individual, in either of these categories, will state what he thinks ought to be done rather than what is actually done. Job analyses must reflect what responsibility the worker has today.

The analyst observes and interviews the job incumbent for basic data. Then he goes over the description with the supervisor. If the supervisor does not agree or says the in-

cumbent performs some operation, etc. that is not listed, the analyst will go back to the worker and clarify the description (the job analyst will observe to see that the worker actually performs what he says he is doing).

After the description is written (and actually reflects what the worker is doing) the description goes to the union. The union has thirty days to accept or reject the job analyst's findings. If there is no acceptance, a conference is called between union and the wage and salary administration. If the conference does not result in agreement, the union has ten days to drop it or bring the matter to arbitration.

Union Participation in the Job Analysis Program. Two-thirds of the large companies are unionized, and of these only a few are concerned with job analyses.

The union in Company 121, a large size company, requested a job description program in a recent contract, but it would have no part in the actual writing of the descriptions. The final job descriptions will be bargainable. This was the case with a few other companies. However, for the most part the unions did not put any pressure on the companies to conduct the analyses or to conduct the analyses in a particular manner. They were only interested in the job classifications that resulted from the descriptions.

Company 051 and Company 271, two large size, unionized companies, avoided performing the job analysis function, because they wished to avoid union interference. Two others, Company 311 and Company 321, had to submit each job description to the union for approval.

Eight medium size companies out of fifteen were unionized. Company 022 is conducting job analysis in order to comply with a recent committment made to the union to conduct job evaluations. Of the remaining companies, only Company 242 has had to submit the descriptions to the union for review. The unions in the other companies were not particularly interested in this phase of personnel practices.

Only three of the eight small size companies in the total study were unionized. Two of these, Company 153 and Company 203, require approval of job descriptions from a union representative. In the case of Company 203, the description is discussed with the chief union steward before its submission to the union for approval.

Updating of the Job Analyses. This question sought to determine if job analyses are updated periodically, and, if not, who would initiate the changes. Table 4 has already indicated that six companies had dated analyses. But of the companies who stated that they had current descriptions or were presently conducting programs, how many would conduct the

analysis on a periodic basis, or, if not on a regular basis, how many would delegate responsibility to an employee to see that the analyses are rewritten as job content changes? How many companies would depend on the union to request a new job analysis?

Only three companies -- Company 311, Company 321 and Company 391 -- of the twenty-five companies that have job analyses conduct periodic audits. The remaining companies update their analyses at irregular intervals. Many of these have a "crash" program: in some cases the updating has taken place every ten to twenty years.

The companies that do not update their analyses regularly usually delegate responsibility to the supervisor or foreman to initiate changes, even though a number of those interviewed said that this was not a satisfactory method.

Two large size companies, Company 311 and Company 321, would write or review job analyses (1) at the request of the union, (2) at the request of the supervisor, and (3) by a periodical audit.

Detail of the Job Analyses. Although many of the job analyses were not seen by the author, those that were seen can be mentioned here. The important question in this area is whether the analyses were complete. Do they fully describe the job duties and the specifications needed of a worker to perform

the job? Are there factors identified?

Among the large size companies, Company 211 describes the job duties and identifies the factors: education, experience, tools, equipment, major duties and minor duties (or instead of the last two) personnel duties and management duties. Company 311 has analyses that are divided into three areas: identification of factors, general summary statement and specific duties.

The job analyses in another large size company, Company 371, are broken down into a general summary statement and typical duties. No factors are identified. Company 421 is only including specifications in its currently written job analyses. Plans are to include this information on all of the old job analyses.

Of the medium size companies, Company 072 writes its descriptions and, when they are completed, takes them through the *Dictionary of Occupational Titles (DOT)* to determine if the description fits the job title and description as presented in the *DOT*. This "fit" to the *DOT* listing is considered important, because it keeps "the job descriptions from becoming ridiculous." There are no factors. Company 092 lists three factors in its job analyses: education, experience, and responsibility.

Presently, jobs are being analyzed and updated in another middle size company, Company 162. The descriptions

were formerly as brief as: "cuts coil with band saw."

Company 282 has descriptions for its approximate thirty factory jobs in the company. The descriptions average about five typewritten lines in length and they are of a general nature. Similar descriptions exist in Company 382 except that they are less than two to three lines in length.

Question Number Two Through Question Number Eight

This series of questions completed the survey of the job analysis area. The questions are listed in Table 2.

Question Number Two. This question attempted to determine if the job analyses not only describe the job duties, but interpret these duties in terms of human specifications necessary to perform the duties. Such specifications would usually be stated in terms of factors. Table 8 presents the data.

TABLE 8

COMPANIES HAVING FACTOR SPECIFICATIONS INCLUDED IN THE JOB ANALYSES

Response Categories	All Cos.	Company Size A	B	C
Job Descriptions Only	15	6	5	4
Job Descriptions with Specifications	10	6	3	1
Job Descriptions with Modified Specifications	4	2	2	0
D/K	1	0	1	0
Totals	30	14	11	5

Most of the large size companies did not state specifications in the job analyses which, in fact, should be more properly called job descriptions, as the true job analysis contains duties and specifications. When the interviewees of these companies were asked how the personnel department would know what kind of things to look for in an applicant if the specifications were not stated, the response was that this information was usually supplied by the supervisor. He would identify the necessary qualifications in the employee requisition that would be sent to the personnel department.

Company 031, a large size company, originally included five factors in the job analyses. The factors have now been discontinued and only the job descriptions remain.

Among the companies that had job descriptions with specifications, only Company 121 of the large size companies and Company 083 of the small size group have a rather wide range of factors identified in the job analyses. In the other companies of the Job Descriptions with Specifications category, the factors are not sufficiently described. For example, Company 121 identifies four factors in its job analyses, although there are no levels as such. A brief description follows the factor: read and write, speak and understand English, minimum grammar school education.

Company 421 and Company 431 are in the Job Descrip-

tions with Modified Specifications category as their analyses include factors only to a very limited extent; both companies state the education level required.

Company 022 of the medium size companies is the only company in the D/K category, as the information given by the reluctant interviewee was insufficient to qualify it for any of the other categories.

In summary, fifty percent of all the companies in the study which conducted job analysis programs did not have worker specifications stated in the documents. There was no indication of the skills and characteristics needed in filling various jobs in the plant, although many companies did require the plant manager or supervisor to furnish descriptive material to the personnel office in the form of a worker requisition. But the procedure was usually not standardized and would not be a satisfactory document for the validation process.

Question Number Three. Question Number Three attempted to discover what relationship existed between the job analyst and the testing personnel. The term job analyst is used loosely here to mean the individual within a company who conducts the job analysis program. In some cases this would be the supervisor, the industrial engineer, or any individual performing the duties of the job analyst. The greater the relationship between the analyst and tester, the easier it would be for synthetic validation to take place. Table 9 summarizes the data.

TABLE 9

RELATIONSHIP BETWEEN THE JOB ANALYST AND THE TESTING PERSONNEL

Response Categories	All Cos.	Company Size A	B	C
Same Department	11	6	4	1
Different Departments but Related*	4	3	1	0
Different Departments and Not Related**	3	1	2	0
N/A	9	4	3	2
Other	2	0	1	1
Insufficient Information	1	0	0	1
Totals	30	14	11	5

*For example, wage and salary administration and the personnel department, industrial relations and the personnel department.
**For example, manufacturing and personnel department, industrial engineering department and personnel department.

In the first category, Same Department, the job analyst function and the testing function could well be performed by the same individual.

In the N/A category Company 031, Company 121, Company 231 and Company 371 of the large size companies, Company 282, Company 352, and Company 392 of the medium size companies, and Company 083 and Company 203 of the small size companies do not have testing programs. Therefore, they would not have testing personnel.

The Other category in the medium size company classification includes one company, Company 132. This company has

its analyses performed by an outside consultant; testing is conducted by the director of industrial relations. The small size company, Company 153, in the Other category uses an outside consultant to conduct its job analysis program and testing program.

Question Number Four. This question did not elicit much information, because few companies actually select an employee sample in the writing of job analyses. This was discussed under the heading Method of Conducting Job Analyses in the earlier part of this chapter.

Question Number Five and Number Eight. These two questions are considered together. Originally, Question Five was meant to be related to Question Number Four in terms of employee samples. So few companies, however, used these employee samples that the question had little relevance for purposes of the study.

Question Five and Question Eight, however, are related to the extent that responses to either one would indicate whether or not the analyses, as they are written, are idealistic, or whether they attempt to reflect what actually takes place in the production area. Do the analyses honestly present the duties and specifications as they are performed by the workers who are on the job? Table 10 summarizes the data. For the companies that had dated job analyses, the information was more opinion than fact.

TABLE 10

JOB ANALYSES WRITTEN AS IDEALISTIC OR REALISTIC

Response Categories	All Cos.	Company Size A	B	C
Idealistic	3	1	1	1
Realistic	24	13	8	3
D/K or N/A	3	0	2	1
Totals	30	14	11	5

Company 031, the large size company that stated that the job analyses were idealistic gave the following reason for doing so: The job analysis may be ideal in so far as the minimum requirements are concerned. The sporadic nature of the company is such (because of the military contracts) that workers must at times be transferred from one job to another. Therefore, there are often comprises: a worker will be placed in a job even though he does not meet the minimum requirements. Therefore, the stated job description would serve as a training guide; it would indicate the training necessary.

Company 162, a medium size company that is in the Realistic category, is conducting job descriptions realistically in the first stage of development. A later stage, however, will reflect ideal descriptions.

Question Number Six. This question was originally designed to find out whether the job analysis programs were

standardized. In other words, was the same format or checklist used in all analyses? Results, however, indicate that all companies, with the exception of one medium size company, use the narrative form. The narrative varies from a single line in one company to two single spaced pages in another. The exception to most of the electronics companies, Company 252, used a checklist form.

Question Number Seven. This question is strictly related to Number Eight; Number Seven focuses on the factor specifications while Number Eight is more concerned with the job duties.

Only ten companies (see Table 8) had specifications listed in the job analyses, and of these ten companies none used inflated job specifications. The specifications reflected what realistically could be expected of applicants in order for them to successfully perform a given job.

Part II

Questions Number Nine and Number Ten

These two questions were designed to find out the degree of standardization and sophistication that the job evaluation program had in each company and to determine if the job evaluation programs deviate much from one company to the other in the electronics industry.

Description of Job Evaluation Methods Used in Various Companies. Because a variety of evaluative methods can be found in the forty-three electronics companies surveyed, this section will attempt to illustrate a few of the procedures as they were related to the interviewer. The following are excerpts from some of the large size company interviews.

> Company 031: One job (not by factor) is ranked against the others. The jobs are ranked by supervisors, factory manager and wage and salary people. Discrepancies would be worked out in the committee.
>
> Company 051: The job evaluation system is based on the point system and the National Metal Trades Association Job Rating Manual is used except that some of the verbiage has been changed. But the points and factors are retained exactly as they appear in the manual. The verbiage was updated a year ago.
>
> There is not a job evaluation committee. Re-evaluation of a job would be a personnel function. Under the terms of the union contract, the union has thirty days to file an objection. A change can be instituted at any time, and it can occur during the life of the contract.
>
> Company 121: The job evaluation system has been in operation prior to 1960. At the time of installation, the bench mark approach was used, and jobs were compared, in toto, against the bench marks. The job was classified by grade level and these same levels or grades are in existence today. The interesting point here is that the job descriptions currently being written will have no effect on grade level. The description merely gives "fill-in" data to the job title and job grade, and the grades are maintained at the same level.
>
> Company 271: The job evaluations for the non-exempt employees are done by collecting data from surveys of other companies.

Company 291: The job evaluations were completed by the consultant from NMTA.

Company 311: The job evaluation system is composed of a job evaluation manual (point system) that contains twelve factors and also an hourly factor comparison. The points are originally assigned by the job analyst (after the description has been accepted by the supervisor, union, etc.). The analyst would go over the evaluation data with the supervisor (although the supervisor does not have any say in evaluation). Then the analyst would assign points and, in addition, compare the evaluation, factor by factor, with other jobs, factor by factor. If the evaluated job looks out of line as compared with other job factors, the analyst will take a serious look at the other jobs. This evaluation process is repeated by the four other job analysts.

Company 317: There is no committee to reject or approve the wage and salary administrator's evaluations. The evaluations would end with the administrator.

Company 401: The job evaluation goes back to 1957-58. At that time the NMTA job evaluation system was adopted, and a consultant was called in from NMTA to help in the evaluations. The consultant did not do the actual work, but he did assist in the procedure and review.

A committee was set up consisting of members from personnel and the plant, and the system worked (as it does now) as follows:

1. The job analyst would first check the job description to see that it is current.
2. The job analyst would apply the eleven factor system to the description.
3. The evaluation would go to the general foreman, and he would have the right to protest.
4. The analyst would then sit down with the vice-president of manufacturing and the personnel manager.

After a job is evaluated with the points, the wage and salary administrator does a factor

comparison with other similar jobs to determine (or to double-check) the accuracy of the assigned points.

Company 421: Basically, jobs are evaluated in terms of surveys conducted by various agencies throughout the year. In addition to participating in the EPA wage survey, the company responds to twenty other surveys, and these surveys do influence the rates that the company establishes.

Company 431: In the way of job evaluation, all that the company has is a wage schedule. This document is arrived at by participating in various surveys: *Survey of Wages for Metalworkers, Survey of Industrial Wage Rates* conducted by the Employees' Association of Greater Chicago, etc. These surveys guide the rates that the company establishes and negotiates with the union.

The following are excerpts from some of the medium size company interviews.

Company 072: Jobs are evaluated by a four to five man committee including a member from personnel, industrial engineering, the department affected, the division affected, and a management representative. When this committee meets to evaluate a job, complete agreement must take place on the assigning of points. It is felt that if a member feels so strongly about his position, he should defend it. This is time consuming, but the committee members are better able to justify the evaluation given by the committee in the long run; they have gained time because few job changes in evaluation are required. There is little need for review unless the job content changes or a new job is developed.

It is interesting that there is no formal document of the points assigned to the job being evaluated by the committee members. Points are assigned by factor and there must be complete agreement, but a detailed breakdown is not kept. Levels, therefore, are not identifiable.

Company 092: There is no formal job evaluation system in effect, nor is there a job evaluation committee. There is very little change in jobs (most jobs are assembly), and the evaluation has continued as it was originally devised. When new jobs need to be evaluated, the job is merely ranked, in toto (even though there are factors identified in the description), against existing jobs in the company to determine the wage rate.

Company 162: Before the most recent contract negotiations, all jobs were re-evaluated. The job evaluator and the production manager used the NMTA point system and assigned points to different jobs. The foreman was brought in to assist in this operation. The union accepted the total package of evaluations. The reason NMTA was used, in addition to its acceptance by management, was that the union accepts such a system.

Company 222: The job evaluations were conducted by having each worker describe his job. Then the industrial relations director and the supervisor would go over the results once again with the plant superintendent. This group of three discuss the distribution of points to be assigned each job, and full agreement is attempted.

Company 252: Job evaluations are based on a variety of wage surveys that are constantly being conducted. The evaluations of the various jobs are approved by the board of directors.

Company 382: The job evaluation system, which has been in effect a number of years and has not been changed, is merely a job ranking method in order to produce a hierarchy. Jobs do not change that much from time to time, and the original simple ranking method is still quite effective. The point system has not been used because it is difficult to explain, especially when all the points are put together for a particular job and the total falls five points short of the higher grade level.

> Company 392: The job evaluation system is based on the point system. The system was originally based on NMTA, but through the years it has been altered so that now what remains is a "hodge-podge." The system should be revised, especially because there are a total of 2,000 possible points. That many points make for a refined system, but there have not been enough personnel to review and revise the system as it is needed.

The following are excerpts taken from some of the small size company interviews.

> Company 153: The job evaluation or the rate setting shows no consistent pattern. Sometimes bench marks are selected in the industry for comparison purposes; sometimes the bench marks are selected within the company.

> Company 203: Surveys of other companies are used in arriving at an evaluation of a new job, but when the job is merely an "off-shoot" of an existing job in the plant, then the job is merely compared with existing jobs in the plant. The job is taken as a whole and compared with the same job as it exists in similar companies.

> Company 333: The jobs were evaluated by the director of industrial relations. He observed the jobs and participated in various surveys in order to evaluate.

In summary, the companies used a number of job evaluation methods, the most common of which was the point system. Many companies, twenty-three percent, depended on the wage survey method to evaluate jobs within their own organization. The data for all companies is shown in Table 11.

Three large size companies, Company 311, Company 321, and Company 401, combine the point and the factor comparison

TABLE 11

JOB EVALUATION METHODS USED BY PARTICIPANTS

Response Categories	All Cos.	Company Size A	B	C
Point:				
NMTA	10	5	5	0
NEMA	3	1	1	1
Other	12	5	5	2
Factor Comparison	0	0	0	0
Classification	2	2	0	0
Ranking	3	1	2	0
Wage Survey	10	4	3	3
Other	1	0	0	1
N/A	2	0	1	1
Totals	43	18	17	8

methods: the factor comparison is used as a check on the accuracy of the point system. One small size company, Company 013, does likewise.

Company 211, Company 261, and Company 441, three large size companies in the Point System, Other category, as well as Company 072, a medium size company, use a point system similar to the one used by the National Electrical Manufacturers Assoc. (NEMA). Company 103 of the small size companies, classified in the same category, represents a rather unique case. It, too, uses a job evaluation system similar to the NEMA: the points are the same, but the degrees are defined differently. Its uniqueness lies in the fact that it was the only instance, among the forty-three companies interviewed, which assigned a level

"0" to one of its factors. This practice is contrary to the use of factors where some degree of the factor must be common to all jobs in the job family.

Company 282, a medium size company in the Wage Survey category, has dated job evaluations. Therefore, the method used in conducting them was only indicated as a wage survey method for convenience in classification. Company 203, a small size company in the same category, uses the wage survey method only at the initial stage of evaluating a new job. When the new job has been evaluated, it is taken as a whole and compared with jobs in the plant, or with the same job as it exists in similar companies.

Company 022, a medium size company, is in the process of revising its job evaluation system and the method to be used has not been determined yet. This company is placed in the N/A category.

Use of Committees in Job Evaluation. The author attempted to determine if a committee, as such, evaluates the jobs and, if so, to what extent this committee functions as an entity. Was the committees' work well structured and defined? Did members of the committee have equal approval power? Who served on these committees?

Only two large size companies, Company 311 and Company 321) had committees that were formally organized. Job evalua-

tions in four other large size companies (Company 211, Company 261, Company 401, and Company 441) were arrived at using informal committees.

In Company 311 and Company 321 the committee is composed of job analysts. The other four companies mentioned above usually have members from the personnel area and the plant.

In the medium size companies, Company 072 has a formal type committee consisting of members from personnel, industrial engineering, the department affected, the division affected, and a management representative. This committee meets and must succeed in getting 100 percent approval on any evaluation.

Company 132, Company 162, Company 222, Company 142, Company 352, and Company 392 had informal committee proceedings. These committees usually consisted of the individual in charge of job evaluation plus one of the following categories: the plant manager, the production manager, the supervisor and plant superintendent, or members from industrial relations and personnel.

Many companies stated that they had committees in the organization, but what actually existed was an opportunity for certain members of the organization to express their opinions before the document was approved by the vice-president of industrial relations, for example.

There were no committees in existence in any of the small size companies.

Union Participation in Job Evaluation. Of the two-thirds of the companies in the survey that were unionized, none allowed the unions to be represented on the job evaluation committees. Union participation in the evaluative process is limited to the following: (1) approving or rejecting the document after it has been accepted by the company, (2) bargaining over the evaluations at contract time, and (3) reevaluating the job using union personnel.

Only one small size company, Company 203, consulted with the chief union steward in the job evaluations. This practice was also used in one large size company, Company 371.

Company 282 and Company 352 agreed by contract to discuss changes with the union.

Retention of Job Analyses Factors in Job Evaluation. This area of inquiry would apply only to the twelve companies in the study (Table 8) which stated that they had identified factors in the job analyses. These companies retained the factors for job evaluation according to the following: Of the six large size companies that stated that they had factors in the job analyses, only Company 341, Company 311, and Company 321 said that they did retain the factors. Company 261 and Company 211 did so, too, although they identified more factors

in the evaluation than they had done in the analysis. Company 121 gave a negative answer.

Of the five medium size companies identifying the factors in the job analyses, only Company 072, Company 352, and Company 412 said that they retained the factors. The only small size company, Company 083, which had job specifications included in its job analyses, retained them in its evaluations.

Part III

Questions Number Eleven Through Number Eighteen

The remainder of the structured interview consisted of a number of questions designed to appraise the test selection program as it currently exists in the electronics companies with regard to the shop employees.

Questions Number Eleven and Number Thirteen. Because it is not possible to categorize the testing information in a refined manner, Questions Number Eleven and Number Thirteen will describe the kind of testing programs that exists in the different companies, and the kind of research they conduct in regard to testing. Tables 12 and 13 indicate generally who has testing programs and how many companies conduct research.

Of the twelve large size companies that indicated that they had test selection programs, Company 181, Company 231, and Company 291 give only limited tests and for all practical

TABLE 12

ELECTRONICS COMPANIES HAVING TEST SELECTION PROGRAMS FOR THE SHOP AREA

Response Categories	All Cos.	Company Size A	B	C
Have Test Program	27	12	12	3
Do Not Have Test Program	15	6	4	5
No Response	1	0	1	0
Totals	43	18	17	8

purposes could be considered in the Do Not Have Test Program category. Company 072, Company 132, Company 162, Company 172, Company 222, Company 252, Company 282, and Company 382, all medium size companies, made very limited use of tests and could hardly be considered as having a test selection program as such.

Company 153, a small size company, has a testing program for upgrading purposes only. Company 242, a medium size company, did not give any information on the testing program in the organization.

Although the results of Table 12 indicate more than half of the electronics companies use testing, only fourteen companies have a well defined testing program.

Table 13 indicates the number of electronics companies who conduct research on their test selection programs or who participate in a research program that is directed by an outside agency (a university, for example). The test research that takes

place in the electronics industry, without exception, has to do with validation. Only one instance is recalled where reliability research was mentioned, although four companies are doing item analysis.

TABLE 13

COMPANIES COOPERATING IN A TEST RESEARCH PROGRAM OR CONDUCTING THEIR OWN RESEARCH ON TESTING...BY TYPE OF RESEARCH

Response Categories	All Cos.	Company Size A	B	C
Conduct Research:				
Concurrent Validation	7	2	4	1
Predictive Validation	4	3	1	0
Concurrent and Predictive Validation	3	2	0	1
Other (Experience and Observation)	4	2	2	0
Do Not Conduct Research	9	3	5	1
Totals	27	12	12	3

Five of the nine large size companies who conducted research on their testing program did so using formal research techniques. These companies included Company 401, Company 311, Company 321, Company 441, and Company 271. The other companies employed informal research methods (the studies were not well controlled, lacked any statistical treatment, and were performed on inadequate samples), especially the two companies in the Other category. These two companies, Company 291 and Company 431, used very informal type research: follow-up through observa-

tion. Company 181, Company 231, and Company 421 did not conduct research on testing programs.

The middle size companies conducted only informal type research on the testing programs. Company 172 is listed in the Concurrent Validation category, but its placement there is questionable since its validation research is conducted on very small samples. Company 062 is located in the Do Not Conduct Research Category, but it has conducted concurrent validation research on one of the tests in the company test battery.

Company 333, a small size company, is placed in the Concurrent Validation category. However, like Company 172, its placement is questionable because of the nature of its samples; the samples are too select and small.

Thirty-nine percent of the electronics companies which conducted research used concurrent validation in doing so. This type of validation research was the most popular form.

The following excerpts are taken from the interviews with the forty-three electronics companies. These excerpts will give some idea of the kind of programs that various companies use in relation to their test selection programs.

> Company 181: There are no tests at the present time for unskilled workers. The SRA Mathematics Test is used in selecting some of the skilled workers, but there is no rational use of test norms. No studies had been done on present employees to find out how they score on this test.

Company 231: There are no tests given in the factory. They feel a good interview is as good a screening device as any test. However, they do test office workers, and this is mentioned here because of the kind of norm data that is collected.

When office tests were first given (Wonderlic, Minnesota Clerical, etc.), national norms were used. Now, however, they have attempted to develop their own norms in the following manner. The test is validated concurrently by giving the test to a group of workers. The supervisor is then asked to select a good worker and this worker's score on the test constitutes the score for the above average worker. The same is done for low and average workers and their scores. The range of scores of these three then serves as a guide for selection. An applicant should be within this range. The employment manager said that the good worker is the one who usually gets the highest score.

Predictive validation has been attempted by testing all applicants and following the performance of those selected, but this is done on a small scale.

Company 231: The only test given is a simple mathematics test to see if the individual can perform basic mathematics operations.

Company 261: There are a number of pre-employment tests currently used or being validated. These tests are the SRA Mechanical Aptitude, the Flanagan, the Fitzpatrick Supervisory Test, the Bennett Mechanical Comprehension, the Purdue Pegboard, the Purdue Blueprint Reading test, the Wonderlic, home-made electronics tests, and work sample tests. The SRA non-verbal is currently being validated.

These tests are selected on a rational basis, and the compensation and safety manager stated that when they validate the tests, they are careful to avoid any test or item that would give the current workers an advantage in answering over the applicants. For example, an item referring to the inside of a particular piece of equipment could easily be passed by the current workers, but the item would be difficult for one who has

never had the opportunity to see inside this piece of equipment before.

Validation studies are conducted by the employment manager. He uses statistical concepts and reports to supervisors in terms of expectancy tables.

When a test is first used, they will test all current employees and compare the results with the publisher's norms. If there are differences, an attempt is made to reconcile them.

An interesting follow-up is made on applicants who enter with satisfactory scores. A comparison is made of those who are successful (meaning those who are accepted after a probationary period) and those who are discharged.

The SRA non-verbal is currently being validated on all male, unskilled workers.

Validation studies are constantly being carried on.

Company 271: There are a number of tests used at the shop level. The following tests are used in combinations for selecting workers, and different levels of the same test are used for different jobs: Thurstone Test of Mental Ability, Bennett Mechanical Comprehension, Revised Minnesota Paper Form (for mechanical inspection), SRA non-verbal, Flanagan Inspection Test, Purdue Blueprint Reading Test, and company-devised test for electrical inspectors.

The company does not test for every job in the shop. The very skilled and some unskilled are not included.

The tests were originally selected on the basis of the recommendations of a consultant. However, the company first analyzed the jobs for the consultant (since there are no written job descriptions). The selected tests are related to job specifications that were furnished the consultants.

The company has used the consultants' recommended cut-off scores for eight to ten years, but now the test supervisor is attempting to validate the tests. He wants to do concurrent and predictive validation, and he is validating against job performance. Job performance is determined by output (most of the shop jobs are bonus jobs) and the supervisor's evaluation.

The test validation studies have just begun, but they will be carried on continuously from now on.

Company 291: Other than eye tests for assemblers, the only test used is a home-made test used to select technical people and inspectors. The test was developed from the nature of the job and has been validated by following up those individuals who have taken the test. This follow-up is conducted informally.

Company 311: First of all, there is a testing specialist and two people with psychological and statistical backgrounds.

Testing of production workers is in an initial research stage. The company has constructed its own tests and also uses SRA Short Employment Tests (SET) and the SRA Non-verbal which is a culture-fair test. Predictive validation is the only form of validation used.

In deciding on a test, the testing personnel do so by first determining from the specifications the critical factors that are necessary to achieve success on the job. The tests would be based on the critical factors chosen.

The company has been reluctant to select factory employees based on test scores because of ethnic considerations. However, the data it is now collecting is used for research. Employees are tested when they come into the plant, but their score is not a consideration in selection. They are hired without reference to the test score. Later, formal follow-up studies are conducted and are based on the job and ethnic groups within the job group.

The employees are followed up based on supervisors' performance ratings (the supervisors do not see the test scores) and tenure. When asked about those who leave the company before their performance is followed up, the interviewee said that this is a problem, but in their research these employees are treated as the worst kind of workers.

The company feels it needs much more data on ethnic considerations before tests can be used for selection.

One supervisor told the testing personnel that since they had started testing (the supervisor did not know it was test research data only), the degree of turnover had been considerably reduced. The interviewee hypothesized that this could in part be due to the fact that the employees selected felt that they were a special group.

Independent validation is done on each cultural group.

Company 401: The only two tests used are the Purdue Pegboard for assemblers and a Numbers Relations Test used in the selection of stock clerks and storekeepers. With the Purdue Pegboard, suggested norms have been used, but these have been "hit and miss norms." In the case of the Numbers Relations Test, a psychological consultant determined the cut-off scores to be used, and all of the present incumbents in the jobs of stock clerk and storekeeper have taken it. This body of data supports the cut-off score.

Depending on the labor market conditions, the production department will overrule the use of test scores in selection.

In the case of the Numbers Relations Test the fact that the job incumbents were employed was used as a measure of success.

Company 421: The only test used for shop people is a Basic Electronics Test that is used for selecting technicians. Although the score is not the determining factor, it is taken into consideration. The test consists of ten questions and the cut-off point is at seventy-five percent of the test (applicant should be able to answer seven out of the ten questions). All technicians now on the job would have taken the test, but there has been no follow-up on the test scores.

Company 431: The company gives a number of tests. For the shop area they administer the following: The Purdue Pegboard, the Bennett Mechanical Comprehension (different forms are used for various level jobs), Flanagan Industrial Tests, Industrial Psychology Test for testers, Purdue Test for machine operators,

SRA Mechanical Aptitude Test, and a work sample test. There are two forms of the Flanagan used, and the score achieved on either of these forms help determine the level of inspection at which an individual is qualified to work.

The company uses published norms and unofficial observation of those selected in order to determine if the test is predictive. The reason more concurrent and predictive research is not conducted is due to the fact that time is the big factor.

Company 441: All shop employees take a battery of three tests that were developed by two psychologists in Chicago. These tests are the Number 10 Test (General Ability), the Number 20/20 Test, and the Number 55 Test. The latter two are memory type tests concerned with reversals and association.

The same cut-off score is used for all jobs in the shop area. The cut-off score as it now exists rejects twenty percent of applicants on the basis of the test. The other eighty percent qualify and are then accepted or rejected for employment on the basis of other factors. Of the eighty percent who are elegible, only one in ten is acceptable for employment.

The psychologists spent many hours at the company selecting a test based on job qualifications. In addition, the test battery was given to all applicants from six to eight months for research purposes only. Test scores were not used for selection. Later, supervisors rated employees on IBM cards, and tests were validated, and cut-off scores determined.

A Video-Motor Test is given to all females for assembly and insertion jobs. This test along with the others was developed at the Illinois Institude of Technology (IIT). A technical test is also used for technicians, but this test helps with placement only. There are three major categories on the test, and this particular instrument was developed by the company.

IIT conducts research for the company, and personnel at IIT would recommend changes.

Company 022: The personnel manager stated that they use aptitude tests for selection purposes and for promotion. He stated that they use a test by SRA and also one put out by a firm in New York (a personality test). In addition, the personnel manager has constructed a mechanical aptitude test, and he has validated it on the basis of supervisors' ratings. He said the test has direct application to the product produced by the company.

Validation hasn't been terribly scientific and has been mostly trial and error. There was a predictive validity study done at one time. When a new job was created in a department, the individuals to fill that job classification were selected on the basis of an intelligence test. A later follow-up showed the test to be highly valid.

The personnel manager said that testing has been fairly successful at the company, but those tests that have standard norms are not so successful.

The interviewee cited a case that was facing him at the present time. On one of the home-made tests, four individuals who sought a promotion had failed this test. These four had seventeen years experience, thirteen years experience, seven years experience and four years of experience at the company. Another employee who had only one month of experience at the company had passed the test. Now the question that faces the personnel manager is: Is the test valid?

Tests are often validated on small numbers of workers, sometimes as few as ten.

Company 062: There are two tests used to screen all assembly workers, the Purdue Peg-board and the MacQuarrie Test for Mechanical Ability. Originally, a consulting firm had recommended five tests to be administered, the MacQuarrie Test for Mechanical Ability, the Purdue Pegboard, the Personal Audit, the Western Personality Inventory, and the Adaptability Test. Three of the recommended tests were dropped, because the applicants

(especially older women) would state that by the time they took the battery of tests, they would have six job offers from companies down the street. One of these five tests was supposed to identify alcoholics.

Cut-off scores were suggested by the consulting firm, but the company tested its own shop employees and found the scores to be much lower. These shop norms were then used for later selection. When asked if the group in the shop was performing satisfactorily at the time of test validation, the answer was "yes."

The tests could have been related to job specifications, but they would have been specifications that the consultants identified.

The only validation study conducted is the one mentioned above on the Purdue Pegboard. This was concurrent validation and performed on a very small sample.

Company 072: There are three home-made tests used, one for tool and die makers, one for inspectors, and one for technicians. These tests are short and are directly related to the kind of work the individual will perform. These tests are very simple and were constructed so in order not to jeopardize the company with the Office of Equal Opportunity.

The tests which were validated on current workers are interpreted by supervisors, and these supervisors will establish the cut-off score. This score could variate depending on market availability of workers. The supervisors not only consider the total test score, but they examine the areas of errors made on the test.

Tests are not used on the assembly line because much of this kind of work has been de-skilled. Assembly is at a very sophisticated level. Solderers have been replaced with electro-mechanical connections. The company is very automated even though they function on a job shop basis.

Company 172: The testing program as it exists is used with a great deal of flexibility. Tests are only used if there exists doubt about

a particular applicant. The same is true in cases of upgrading.

Two tests used in doubtful cases are the Purdue Pegboard (for assemblers) and the Bennett Mechanical Comprehension (for mechanical assemblers). The test would not be given if an individual's background would indicate success in the area. Furthermore, a three month probationary period gives the company an opportunity to verify their conclusions.

Norms are established by selecting an average worker (sometimes two) from a job, giving that individual a test and then using the score as a cut-off point. When asked how an average worker would be selected, the interviewee said it would be done by the supervisor and performance appraisal.

Company 222: Only the Purdue Pegboard is used to select assemblers. The norms have been developed through experience. Although there was no standardization on workers in the plant, those applicants selected were followed-up later.

The test is used with flexibility, and individuals are hired in some cases even though they do not surpass the cut-off score.

Company 252: The Purdue Pegboard is used for assembly workers, and the Short Employment Test is used for stockkeepers and clerks. The norms were established through experience; individuals who took the test were followed-up later. Originally the publisher's norms had been used, but now the cut-off scores vary depending on the department. There is flexibility.

Company 302: The Purdue Pegboard is used to select wire and soldering personnel. Electronic personnel (Electronic testers, electronic technicians, and service technicians) are given an electronic test of twenty-five questions which are problem-solving in nature. The test was validated on the three different groups of electronic personnel, and different cut-off scores are used for each area of applicants. The test was validated by giving it to the present employees in each category and comparing

it with supervisory evaluations. In addition, for the first five to six months, applicants were hired for these jobs regardless of their score on the test (providing they met the other employment qualifications). The high scorers were then followed-up later.

The electronic test was home-made and validated on separate, but related, groups. The Purdue Pegboard was validated concurrently.

The follow-up was only informally conducted, and there is no formal treatment of the data.

Company 412: A certain amount of tests are used. For some jobs a work sample is used. For example, in the selection of some candidates the supervisor of a department might ask the applicant to measure various parts with gauges, etc. The Purdue Pegboard is employed in the selection of assembly workers, and the published norms are used in selection.

An interesting test that is used for various jobs throughout the plant is the Mental Alertness Test - Inventory No. 11 (published by Stevens, Thurow and Associates). This test takes fifteen minutes to administer, and it has norms based on 500 random selected employees. These 500 employees are broken down in the manual into five sub-groups with 100 in each sub-group. The sub-groups extend from executive down to factory worker. The test is used for various kinds of jobs at the company, and the published norms and the cut-off scores are used.

Before they acquired this test, the company gave the test to people in the plant with different backgrounds based on education to determine the "fit." Only employees who were willing to be tested were tested. The company was satisfied with the results.

The company still relies more heavily on interviewing, but a test score from the above mentioned test would decide a case if a dispute arose. In other words, if two candidates for the same job were equally well qualified, the test could be the determining factor.

Company 013: Considering just the factory, hourly employees, there are some tests used. On applicants for soldering, for example, they are asked to perform some soldering operations.

The personnel director has developed an electronics test for analyzers and technicians that has been quite successful. This test has been used for screening applicants for this job area and also for promotion purposes. The personnel director has performed item analysis and has validated the instrument on the subjective appraisal of the supervisors. Those promoted to a higher level job were the ones who obtained the higher scores.

The test has been validated on sixty-four people at present. The personnel director realizes that this is far from adequate, and he is attempting to validate the instrument on a much larger sample.

The company also uses the SRA Test of Mental Maturity in screening applicants for programming. They originally used a programmer's aptitude test that took one and one-half hours. However, they found the correlation between the Test of Mental Maturity and the programmer's aptitude test to be .91. Since the Test of Mental Maturity takes only twenty minutes to administer, they use only this test at the present time.

At one time they did use a programmer's test put out by IBM, but it did not seem to "fit" their present employees.

Company 103: The Purdue Pegboard is the only test used to select factory workers. The test was selected because it was used at the company where the manager of personnel was formerly employed. This test had proven successful there. The norms that were developed at the previous company were also transferred to company 103.

The Bennett Mechanical Comprehension Test is also sometimes used in selecting technicians, inspectors, and maintenance men. Here subjective experience is used in interpreting the results, and such experience relates to the department, market availability of workers, etc.

Company 333: The Purdue Pegboard is used for assemblers and punch press operators. This test was originally validated concurrently, and the company has "played" with it over the years, so that now the test is "fool-proof."

The Bennett is used for anyone who has anything to do with mechanics. The higher level test was validated by giving it to two or three individuals (including the president of the company) who were considered competent. Then the test was given to those individuals (including the director of industrial relations) who were considered to possess average mechanical ability. This established the range of scores.

Job Comparisons by Factors. Table 14 shows the variance of jobs in the electronics industry, even though these jobs carry the same job title. Means and standard deviations were calculated for each job on the basis of factors within each job.

Although a number of electronics company participants had jobs evaluated on the basis of the National Metal Trades Association job evaluation system, only ten companies agreed to submit the four selected jobs for examination. A few companies were in the process of evaluating jobs on the basis of the NMTA system, but they had not completed the evaluations in time for inclusion in this report.

If a company had job titles that were identical to the four selected job titles listed on page 51, but the job descriptions were different than the ones described, then these jobs that did not agree with the descriptions in the report were elim-

TABLE 14

FACTOR LEVEL VARIANCE OF COMPARABLE JOBS

Factors		Assembler "C" (N=10)	Inspector "B" (N=9)	Shipping Clerk (N=6)	Drill Press Opr. (N=9)
Education	M	1.20	1.94	1.83	1.22
	SD	.40	.36	.37	.42
Experience	M	1.40	2.00	2.08	1.11
	SD	.49	.67	.73	.31
Initiative and Ingenuity	M	1.80	2.39	2.33	2.00
	SD	.60	.46	.47	.47
Physical Demand	M	1.70	1.89	3.25	1.89
	SD	.46	.57	.38	.57
Mental or Visual Demand	M	3.20	3.10	2.83	2.88
	SD	.40	.31	.90	.31
Responsibility for Equipment or Process	M	1.40	1.89	2.00	1.89
	SD	.49	.87	.82	.57
Responsibility for Material or Product	M	1.60	2.10	3.17	1.67
	SD	.49	.56	.90	.47
Responsibility for Safety of Others	M	1.80	1.67	2.50	2.33
	SD	.60	.47	.50	.82
Working Conditions	M	1.80	1.89	2.50	2.11
	SD	.40	.31	.50	.31
Unavoidable Hazards	M	2.20	2.22	3.00	2.83
	SD	.40	.42	.00	.33

NOTE. One factor, Responsibility for Work of Others, has been omitted.

inated. On the other hand, if a company had a job similar to the description in the study, but the job was called by another title, then that job was included in the study. For example, if a company had a job title Inspector "C" which fitted the description in the study for Inspector "B", then Inspector "C" was used for comparative purposes in describing Inspector "B".

Tests Commonly Used in the Electronics Industry. A variety of test instruments are used in the electronics companies, although some companies show much greater use of tests than others. The following tests were used by at least three companies in the study: the Bennett Mechanical Comprehension (used by eight companies), the Purdue Pegboard (used by eleven companies, the Wonderlic (used by three companies), the Flanagan Industrial Tests (used by four companies), the Short Employment Tests (used by three companies), and the SRA Non-verbal Form Test (used by four companies).

Question Number Twelve. Question Number Twelve attempted to discover if the electronics companies in the study used the same test or battery of tests for different jobs in the plant that belonged to the same job family, but that did not have identical job duties or functions. Of the twenty-seven companies having testing programs, only Company 181, Company 261, Company 271, Company 291, Company 311, Company 401, Company 431, Company 441, Company 062, Company 302,

Company 382, Company 412, Company 013, Company 103, and Company 333 stated that they did use tests in this manner. This represents fifteen companies out of the twenty-seven.

Question Number Fourteen. This question was designed to determine if spurious validation might result when a supervisor is allowed to see test results. This spurious validation could occur because a test score of a candidate impresses the supervisor, and the supervisor reacts in a more positive way toward the individual. Results are shown in Table 15.

Company 441, a large size company, stated "yes" and "no" to this question. The employment manager stated that a supervisor does not see the test score unless he has a good reason for doing so. A test score could support the supervisor's request to promote or release an employee.

TABLE 15

SUPERVISORS WHO SEE TEST RESULTS

Response Categories	All Cos.	Company Size A	B	C
Yes	16	6	9	1
No	6	3	2	1
No response	5	3	1	1
Totals	27	12	12	3

Question Number Fifteen. This question elicited little useful information for the purpose of the study. Few companies

tested their present employees for research purposes. Those which did not do so stated that they were not against the practice, and would probably do such testing if there was a good reason for so doing. However, this was more opinion than fact.

Only fourteen of the twenty-seven companies did any kind of validation research on their present employees. Of these fourteen companies, however, many would consider themselves as conducting research if they did a validation study involving more than two employees.

Question Number Sixteen. This portion of the interview considered the role of the success criterion in a company's testing program, and how the criterion was established. Table 16 gives a breakdown of the companies which have testing programs and which use success criteria in test validation. Table 16 also specifies what the criterion is.

TABLE 16

ELECTRONICS COMPANIES USING SUCCESS CRITERION IN TEST VALIDATION AND HOW THIS CRITERION IS DEVELOPED

Response Categories	All Cos.	Company Size A	B	C
Supervisor's Performance Rating	11	3	6	2
Output and Supervisor's Performance Rating	1	1	0	0
Tenure and Supervisor's Performance Rating	2	2	0	0
Tenure	1	1	0	0
D/K	3	2	1	0
Totals	18	9	7	2

Question Number Seventeen. This question which assesses the effect of turnover on predictive validation had only a limited number of responses, because few companies did predictive validation. Of the four that did, Company 271 and Company 441 merely attempted to build up numbers and did not concern itself with the problem of turnover. Two other companies, Company 311 and Company 321, treated the workers who left the organization as the worst kind of workers.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

Discussion Related to Primary Purpose

After analyzing the data, would it be possible to conclude that synthetic validity is a concept that could be applied within a company, as well as among companies in the same industry, for the selection of applicants? Would conditions be such within and among companies as to lend themselves to synthetic validation of test selection instruments? The answer to these questions is a qualified "yes." This conclusion was arrived at through the careful examination of those areas upon which synthetic validity depends--job analysis, job family, and job evaluation.

Despite the fact that the literature stresses the necessity of using job analysis as the basis for synthetic validation, the author, through his study of the electronics industry of Chicago, suggests that job evaluation be made instead the center upon which synthetic validity revolves. This opinion is based on the findings of the forty-three electronics companies that were examined in the study, especially as they relate to the job analysis. Certain practices and conditions were found

to exist in the electronics companies that endangered the quality of the job analysis and presented a questionable aspect to the execution of the program. The findings are discussed below.

First of all, few of the electronics companies in the study conducted job analysis based on the direct observation of the worker. This direct observation of the worker in order to determine exactly what duties are related to the job is considered an important element of job analysis and synthetic validity. Other methods have often proved unsatisfactory. Yet only a small number of companies conducted the analysis program in this manner, and those that did rarely involved most workers in the observations or even a representative sample of those performing a job. In fact, it is not uncommon to find job analysis based on observations of one worker performing the job, regardless of how many workers there are on the job.

Second, only three or four companies had personnel expressly trained to conduct job analysis. These were the personnel who devoted full-time to analyzing and describing the job duties and preparing specifications for the shop jobs. For most of the companies in the study, however, the preparation of job analyses was one of the many functions of a member of the personnel department or a member of the wage and salary administration.

Third, many of the companies had dated job analyses. Other companies limited the job analyses to a few written lines

that described the duties of the job in a general way. Some companies avoided any written record of job duties and job specifications, because they did not want to invite union interference that would limit the nature of the job.

Fourth, only eight companies in the survey used any kind of a committee approach to job analysis. The committee aspect is deemed to be important for synthetic validity, because it is a means of getting nearer to the truth of the job as the job is performed by the workers. The more individuals who are familiar with the job and who are knowledgeable about the performance of job analysis and its application, the more confidence that can be placed in job analyses and the more exact will be the criterional measure for synthetic validation. Most companies in the survey, however, had job analyses written that could be approved or rejected on the basis of one man. These electronics companies made very little use of committees, and those that did had not organized the committees as a formal type of entity. The committees functioned informally and may not have even met together for discussion.

Fifth, only three companies of the total number of electronics companies having job analysis programs conducted periodic audits of the job analyses. Many companies just depended on the manufacturing personnel to notify the administration when a job was in need of a review or when a new job analysis needed to be written. The interviewees admitted this procedure

to be relatively ineffective, because it often resulted in no changes at all.

Sixth, because synthetic validity depends so heavily on the identification of factors that are common to jobs within and between related companies, the study searched carefully at if and how the factors were identified in the job analyses. Less than one-half of the companies (fourteen out of thirty) who conducted job analysis did anything at all in specifying the human factors necessary to successfully carry on the job duties. However, the fourteen companies having the specifications in terms of factors, had only a limited number of such factors. At the most there were three factors or less identified in each company. These factors were usually education, experience, and responsibility.

Seventh, most of the companies in the study attempted to write the job analyses in terms of what workers were doing at the time and to reflect the workers' jobs realistically. To the extent that they succeeded in accomplishing this, one could conclude that a condition for synthetic validity was being met. Yet, the manner in which the analyses were conducted creates some doubt as to how successfully this attempt was accomplished.

Eighth, five of the electronics companies did not perform job analyses themselves, but delegated the responsibility instead to an outside consultant (usually a National Metal Trades Association consultant). The consultant often combined the job

analysis and the job evaluation, emphasizing and structuring the job evaluation program at the expense of the job analysis. Job analysis was merely considered a function of job evaluation.

Ninth, the analyses were conducted in a variety of unstandardized ways both within and among companies. This practice makes it difficult for comparative purposes when commoness is a necessary element for the use of synthetic validation.

In summary, job analysis as it is currently conducted in the electronics industry of Chicago would not be suited to the adoption of synthetic validation mainly because of the following reasons. The analyses are conducted in a variety of unstandardized ways both within and among companies. Few companies identified factors, and those that did have a rather limited number of them. Many of the job analyses are nonexistent or of such a brief nature that they negate their usefulness. Jobs are seldom written comparably in the analyses, and many companies have outdated job analyses.

After assessing job analysis, the study next examined the job families of the electronics companies in an attempt to identify areas of commonality between them as such job families relate to the shop area. Although it was generally quite easy to identify the job family of shop workers in each electronics company, it was much harder to determine the common elements that unify the job family, or to determine the different levels of each job element. The difficulty lies in the nature of the

analysis program, a program which receives little attention in the electronics industry. This would present a problem for synthetic validity, should such validation depend on job analysis as the sole means of identifying the component parts of the job families. Fortunately, however, the factors of a job family can be obtained from the examination of another program which seems to receive more attention than the job analysis program. This other program is job evaluation.

Job evaluation as it exists in the electronics companies of the study holds more promise for the initiation and application of synthetic validity for a number of reasons. For the rank and file jobs in the shop, most companies have evaluation plans that identify the factors that are common to all the jobs in the shop as well as the levels or degrees of each factor. Furthermore, a number of companies have standardized the evaluation program by using the NMTA or the NEMA system. One of the companies using the NMTA system was found to deviate slightly from the others, but for all practical purposes it was the same. This meant that a number of companies evaluate jobs on the same factors and the same descriptive levels. This also meant that the evaluation system of one company could be used to evaluate the jobs of another company. The plans are interchangeable. Consequently, synthetic validity could easily use as its criterional measures the factors and levels identified and developed through the job evaluation program.

The use of committees in job evaluation was also carefully examined in the study, because it was felt, as it was in the assessment of job analysis, that the more individuals who participate on the job evaluation team, the more valid and reliable the evaluations would be. A more valid and reliable evaluation means a better criterion for use in synthetic validity. Without the committee the one man evaluation tends to contaminate the evaluations because of the influence of the present job incumbents and the fact that the evaluator may be overly familiar with the job. Unfortunately, the use of committees was not at all common in the electronics companies, but greater use was apparently made of them in conducting job evaluation than in conducting job analysis.

By concentrating on those companies that identify factors and evaluate jobs using a common evaluation system, factor level data were gathered on four common jobs in the industry to discover if jobs are equivalent from one company to the next when the jobs carry the same job title. Many companies in the electronics industry were found using a common system in evaluating their jobs, and this common system was usually the evaluation plan of the National Metal Trades Association. When these companies were agreeable to giving out specific job evaluation information, the information formed the basis for the comparison of jobs in the study, factor by factor. The comparison found a sizable variance in the levels assigned to each

job factor, indicating that the same job titles do not carry the same job duties and specifications from one company to the next. This variance finding in job factors could be due in part to (1) the questionable validity of some job evaluations, or (2) the different nature of the job content from one company to the other. If the latter case is true, synthetic validity can help the test specialist because it will allow for these differences, whereas conventional validation studies do not. Consequently, better cross-validation can be obtained from the use of synthetic validation.

Job evaluation changes are common in the electronics companies. Such changes reflect the constant state of flux that takes place in job content. Many companies had periodic audits to discover the changes, and others depended on unions to notify the company administration if job content changed but evaluation did not. In either case, the practices indicate that greater attention was being paid to job evaluation than to job analysis as they relate to keeping abreast of changes that take place in job content. It is recognition of this changeability in job content that makes the use of synthetic validity so valuable in a testing program. Synthetic validity obviates the need for constant revalidation of test instruments because of frequent job content changes.

Thus, it appears that synthetic validity can be introduced into an industry of Chicago, because the companies that

participated in the study, for the most part, had elements of commonality that would permit synthetic validation to function. Although job analysis would be of little or no use, job evaluation does seem to fit in quite well with the conditions necessary for synthetic validity.

Another major objective of the study was to determine if it is possible to develop a battery of common tests that could be used throughout an industry. These tests would serve as a common battery in the industry and would form the basis for the synthetic validity concept. Although there was no overwhelming use of any particular test instruments, a number of aptitude tests did show up in usage by many companies. For example, the Purdue Pegboard, the Bennett Mechanical Comprehension, and the Flanagan Industrial Tests were used by a number of companies. These tests would be the logical choice for use in initiating synthetic validation, especially if these tests are already used in those companies that have factors and factor levels that are well defined and common with what exists in other companies.

Discussion Related to Secondary Purposes

Conclusions in regard to the two secondary purposes of the study also were deduced from the development of the survey. First, the study explored the possibility of combining the job analysis and the synthetic validation processes, because both

seemed to have much in common. However, the inadequacy of using job analysis as the basis for synthetic validation has already been determined. Furthermore, few companies, although they do not object to the practice, actually test their present job incumbents or sample the incumbents for job analysis purposes. Secondly, the study attempted to assess the status of testing as it currently exists in a particular Chicago industry, the electronics industry.

Approximately sixty percent of the companies in the study had test selection programs. Some of these companies, however, had programs that were extremely limited, and for all practical purposes these companies could be considered as not having such programs. Of the companies using tests, only five conducted any kind of formal research in regard to the testing program. Some companies did an informal kind of research (informal observation, informal follow-up, etc.), but these studies were not well controlled, lacked any statistical treatment, and were performed on inadequate numbers. Other companies relied on the publisher's norm data, or used the recommended cut-off scores by outside consultants.

The most popular method of validating tests in the electronics companies was the concurrent validation method. This was followed by the predictive validation method. Most of the five companies which had formal research programs used predictive validation. Companies employing concurrent validation often

validated on small numbers of workers, used an inadequate criterion in some cases, and did not employ proper sampling techniques.

The success factor, as identified by the supervisor's performance ratings, was the most common criterion used in validating test instruments. Other criteria used were tenure (the fact that workers were still employed and did not leave the company was a measure of success for some companies) and output.

Implications

Synthetic validity has much to offer the test specialist working in Chicago industry (as well as in other areas), especially where common job factors can be identified in a number of related companies, and where these factors are found to be realistic. Furthermore, if common tests or test batteries can be discovered in an industry, then the elements favor the inception of synthetic validation. A start could be made in the electronics industry by selecting a large size electronics company that uses NMTA job evaluation factors, validating common tests on relevant job factors, and by determining the differences that are significant by factor levels. The validated tests could then be cross-validated on another company in the electronics field that is similar to the first and uses the same job evaluation system. Tables of test score expectancies could then be set up for the test data that is collected on each factor and factor level. The tests that are retained are the

ones that indicate significant differences by factor level between those shop incumbents who are currently in attendance and who meet the factor level requirement.

The test data could later be used by any other company in the industry that evaluates its workers on the same basis as the companies that validated the test instruments originally. High cross-validation should result in the procedure, because test data is gathered on the identical parts of a job as they exist between companies rather than on total jobs. The study found through its examination of job evaluation documents that the total job with identical job title varies a great deal between the companies and usually amount to low cross-validation in validation studies where the total job is used as the criterion.

However, before the inception of synthetic validation, some attention first needs to be given to the area of job evaluation validity. Better use of committees and refinement of job descriptions must be done to make the factors in these companies more valid. This attention to job evaluation and its factors is extremely important in order that our criterion upon which synthetic validity relies is dependable. A high degree of commonality must exist between the companies' job evaluation practices, and these practices must reflect the exact job factors and factor levels of each job.

Synthetic test validation could be easily incorporated

into the existing test program of the electronics industry if those companies that presently have a sophisticated test validation program would give support to the concept. Through the cooperation of the members of the Electronics Personnel Association, a pilot program could be inaugurated that would permit an assessment of the job evaluation program in each company. This would be followed by a plan on how to improve and standardize the job evaluation procedure in member companies so that greater confidence can be placed in their use. Finally, tests would be validated and cross-validated on the basis of the job evaluation factor levels. Perhaps it would be wise to first concentrate on a few jobs in the industry and to designate a job evaluation team from the EPA membership that would evaluate the jobs in the various companies. This practice will insure a valid evaluation and a degree of standardization that is important to the concept under study. Then the few selected jobs can be placed in focus and studied until it can be shown that the validation concept works and that synthetic validation can be useful for all member companies who conduct testing.

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APPROVAL SHEET

The dissertation submitted by Raynard J. Dooley has been read and approved by members of the Department of Education.

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

July 1, 1968
Date

Samuel T. Mayo
Signature of Adviser